

ROCKS and MINERALS

Vol. 2

DECEMBER, 1927

No. 4

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*Published by***PETER ZODAC**

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THE BULLETIN BOARD

A ROCKS AND MINERALS ASSOCIATION

Our subscribers will be interested to hear that an effort is now being made to organize a *Rocks and Minerals Association*, whereby each subscriber will be made a member. We believe the opportunity was never better than now. The purposes for which we will organize are:

To stimulate public interest in geology and mineralogy; to endeavor to secure the practical conservation of mineral localities and unusual rock formations and to revive the interest in minerals and mineral collecting that seems to have almost disappeared. The Association will attempt to accomplish this by interesting and educating the younger generations through this magazine and by what it hopes may be a successful endeavor to have geology and mineralogy taught in the public schools.

We believe that no branch of nature study offers a greater interest to the student or gives him a greater satisfaction. His accumulating specimens will fill his cabinet with a permanent beauty which will excite the admiration of his friends and afford him a keen enjoyment. The seeking of specimens will lead him into the open, to places he might otherwise not visit, and the searching out of minerals in quarry, mine, or native rock will develop and enlarge his powers of observation in every direction. The determination of species and varieties will demand the exercise of his best thought and tend to make him mentally keen in his reasoning powers. In making

geology, mineralogy or any of their branches his hobby he is choosing something which will give him physical and mental health and intellectual enjoyment.

A subscription to the magazine makes one a member of the Association, 90 per cent of the subscription price going to the magazine, and 10 per cent as dues to the Association to cover cost of furthering the Association's membership.

We hope, as our Association becomes large in numbers, to induce the Federal and State Governments to have reports made by engineers and inspectors upon large works, of the minerals encountered as the work progresses.

If our readers have any suggestions as to plan, scope or purpose of the Association we will be pleased to hear from them.

Further particulars will be given in our next issue.

ROCKS AND MINERALS wishes to each and all of its readers a very MERRY CHRISTMAS and a HAPPY NEW YEAR.

The Editor would like to take each of you by the hand and personally express to you this very real and sincere wish for your success and happiness.

WANTED: Correspondents in all parts of the world who will be kind enough to send us notes and news items on minerals, etc., that they

think may be interesting to the subscribers of "Rocks and Minerals." Such as are available we shall be very glad to print in the magazine.





ROCKS AND MINERALS

Published quarterly and devoted chiefly to rocks, minerals, ores, crystals, gems, fossils, etc., in the interest of the General Collecting Public.

Published by

Peter Zodac

157 WELLS STREET

PEEKSKILL, N. Y., U. S. A.

Vol. 2

DECEMBER, 1927

No. 4

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EDITORIAL

Although we have had some enthusiastic letters expressing interest and even offering financial support to a monthly issue of ROCKS AND MINERALS, the number of new subscribers and renewals have not been sufficiently great to meet the increased expense of issuing the magazine monthly. We were disappointed that the prizes offered by ROCKS AND MINERALS and by The Gem Shop were not alluring enough to arouse the little activity needed to secure new subscribers and one of the prizes. ROCKS AND MINERALS will, therefore, continue for another year as a quarterly.

Those who, under the belief that the magazine might come out as a monthly, have sent in \$2 will have their subscriptions continued for another year.

We have not given up the idea of making ROCKS AND MINERALS a monthly magazine and shall hope that during the coming year the subscription list may be so enlarged as to warrant the work and expenditure of such a new venture.

Since our last issue we have had a number of letters regarding the formation of Rocks and Minerals Clubs as suggested in the September issue. We assume the allurements of the summer have overshadowed club-life and that as soon as winter comes on and excursions in the field become impossible more attention will be given to the formation of

these clubs. The advantages to be derived from such organizations are many and the prospects of increasing ones collection through exchanges with other clubs as well as the enjoyment of preparing and exhibiting collections of local minerals should prove of the utmost interest to the amateur and professional collector. It is by intercourse with those interested in the same subject or activity that our interest is increased, our enthusiasm stimulated, and our knowledge broadened. During the winter, we shall hope to hear of the formation of a number of these clubs.

It has been most gratifying to the Editor of ROCKS AND MINERALS to learn that the magazine has been used with great success in Physical Geography classes in some of the high schools in the State of New York. As material, ROCKS AND MINERALS is not only available for use in the classroom but it will be found of interest and value to study clubs formed outside the classrooms. It can also be used by these clubs with advantage in their field work.

As to methods, each teacher probably would devise her own. In one high school the magazine was exhibited to the pupils who were informed it would be found in the library, the librarian being requested to put it in a prominent place. When certain minerals were under discussion

in the class the teacher appointed two or three pupils to read up on them in ROCKS AND MINERALS and bring in a written report the next day. These reports were then read and the pupils required to take notes from them and the class was held responsible for knowing at least three of the characteristics thus reported. In this school the magazine proved of real and practical value, the pupils continuing to read the magazine after they had passed beyond the section of physical geography dealing with minerals.

We should like to hear from any teachers who have been using the magazine in their classes and will appreciate it if they will explain their methods and give their opinions as to the availability of the magazine in their classroom work. We shall be glad to print any such articles for the benefit of other teachers.

The Editor of ROCKS AND MINERALS will not be responsible for magazines that are not received by subscribers who have moved and have not notified him of their change of address. If you intend making any change in your address, please notify ROCKS AND MINERALS *in advance* if you wish to secure your copy when issued.

We received quite a number of letters from our advertisers informing us of most satisfactory results from advertising in ROCKS AND MINERALS. A letter

recently received says: "Judging by the response to my ad it (magazine) is surely a going concern." This advertiser has received orders from coast to coast and he says: "They are still coming in."

Another advertiser says: "Your magazine certainly brings results."

We are glad that our advertisers find ROCKS AND MINERALS such a desirable medium in which to advertise.

We very much regret to learn of the death of J. H. Ten-Eyck Burr, who passed away at Point Pleasant, N. J., August 11, 1927. Mr. Burr was one of the warm friends of ROCKS AND MINERALS and a subscriber who was greatly interested in the magazine and its success.

He was a member of the American School of Classical Study in Rome, the Royal Photographic Society of England, the American Museum of Natural History, the Mineralogical Society of America, the Arts Club of Washington, and an original member of the National Geographical Society.

His very fine mineral collection was bequeathed in his will to Colgate University as a memorial of the county in which he was born and lived for so many years.

Mr. Burr is survived by his wife, who was Miss Murray Ledyard, of Washington and Cazenovia, N. Y., to whom our sympathy is extended.

WITH OUR CONTRIBUTORS

We are pleased to introduce to our readers this month, John Melhase, of California, who presents a most interesting article on Arranging the Mineral Collection. His suggestions in regard to dividing a collection into three sections (A) Show Specimens; (B) Type Collection, and (C) Crystal Collection, will probably make a strong appeal to those of our readers who find that even large cabinets become speedily overcrowded with specimens. It would be a great pleasure to look over Mr. Melhase's collection and note the system of arrangement which has been so carefully

and thoroughly worked out by him.

Mr. Melhase is one of our esteemed and enthusiastic friends. His present ambition is to procure a "complete crystal collection" and he will be pleased to hear from any of our readers who may have suitable material for sale or exchange. Crystals are not to be over one inch in greatest dimension and preferably unbroken. Address all mail as follows: Mr. John Melhase, 875 Vincente Ave., Berkeley, Calif.

This is the third article on the arrangement of collections which ROCKS

AND MINERALS has presented to its readers and we expect to print a fourth article a little later which will present a system of arranging which the author says is "all his own." This is naturally a most interesting and popular theme because every collector is confronted with the difficulty of finding sufficient room in limited surroundings in which to properly and effectively display his mineral specimens.

Morrell G. Biernbaum, with whom some of our readers are already acquainted, has a new article in this issue on the Zeolite Localities of Nova Scotia. Mr. Biernbaum and his friends certainly had a most enjoyable and successful expedition to Nova Scotia, and we are glad that he has given us this very interesting account of it.

If any of our other subscribers have visited a famous mineral locality, we wish they would write us about it, that under the title "Famous Mineral Localities of the World" we may have a series of articles dealing with many of those localities which were or are famous for the mineral specimens they have produced.

Frederick S. Eaton, Professor of Botany, of the Connecticut College of Pharmacy, is contributing a series of articles on mineral localities of Connecticut, the first of which appears in this issue. This series, we believe, will prove of infinite interest to collectors who live near enough to make pilgrimages to the mineral localities of Connecticut. Prof. Eaton not only points out the localities in his article but explains how they can be reached, a very important bit of information to one seeking sources of mineral supply.

These articles of Prof. Eaton's should be of special interest to boy and girl scouts.

Another series of articles makes its first appearance in ROCKS AND MINERALS this issue. It covers the phosphorescence of minerals and is written by E. Mitchell Gunnell, who has done considerable research work and experimentation in the

field of "cold light." The first article is more or less introductory and will prepare readers for the intensely interesting information Mr. Gunnell will place before them in the later articles.

Mr. Gunnell has a high regard for ROCKS AND MINERALS and says: "The magazine certainly fills a need amateur collectors have found vacant for a long time—the need of a magazine written in a language the amateur can understand and appreciate."

Dr. Henry C. Dake, is another new contributor whom we wish to introduce to readers of ROCKS AND MINERALS. He has given us a very excellent article on collecting in Oregon and Idaho which we are sure will arouse a feeling of envy among our readers who would like to drive their cars through a mineral country such as that described by Dr. Dake.

Dr. Dake would very much like to exchange minerals with other collectors. Those desiring to get in touch with him may write him as follows: Dr. Henry C. Dake, 793½ Thurman St., Portland, Oreg.

Edward Cahen, A.R.C.Sc., F.I.C., F.C.S., who with William Ord Wootton, is the author of "The Mineralogy of the Rarer Metals," a very valuable handbook for prospectors, published by Charles Griffen & Company, Ltd., Exeter St., Strand, W.C. 2, London, England, contributes a very interesting article on "Metal Discoveries of Antiquity and Today," which we print in this issue of ROCKS AND MINERALS. Mr. Cahen is a well-known English writer upon minerals and particularly the rarer metals with which he is so familiar. He has himself revised and issued the Second Edition of "The Mineralogy of the Rarer Metals." We, ourselves, use this book as an authority on minerals containing the rarer metals.

We know our readers will welcome Mr. Cahen among the contributors to ROCKS AND MINERALS and will look forward with anticipation to other articles from his pen.

WITH OUR SUBSCRIBERS

A most interesting and entertaining letter, descriptive of Mrs. Pearl H. Elliott's trip to California, by way of Cuba and the Isthmus, has been received by ROCKS AND MINERALS. We regret it is too long to print in its entirety but we are very sure our readers will enjoy such excerpts as we have made and will join with Mrs. Elliott in her opinion that a voyage to California by way of Cuba and the Panama Canal is an experience long to be remembered.

"On Thursday, the 21st of April, we went aboard the S. S. Manchuria, which was to be our home for sixteen days. . . . As we steamed past Miss Liberty, a mighty cheer rent the air, and I thought how fitting it was that we had placed France's gift in enduring bronze on the granite foundation as symbol of our enduring friendship. . . . Sunday morning we approached the Florida coast, and soon Palm Beach loomed before us. I wished we might land, for among other specimens I wanted some Coquina, that curious stone which the sea-water makes by cementing small fragments of coral and shells. Old St. Augustine was built of this strange rough stone. But we sailed on without stopping, and the next morning we were in Havana.

Wonderfully beautiful cabinet specimens they had there, copper from the copper mines of Cobre have been worked for three hundred years. Fossil wood from the petrified forest of far-away little Antigua. There was bright red Cinna-bar and good specimens of Manganese. And Stalactites from the Bellamar caves. How I wished we had time to go out to those wonderful caves, some of them one hundred feet high and two hundred and fifty feet long, lined with sparkling dripstone. But it was a thousand miles to the Canal, and the ship would not stop long in port. So the cave trip had to be given up.

Many interesting formations we saw while going through the Canal, and I would have liked specimens from some especially pretty rocks, but there was no way to get them. . . . After leaving the Canal we passed some wonderful mountain ranges in the Central American States, Mexico, and Lower California.

My mineralogist's heart longed for an opportunity to climb those mountains in search of specimens. . . .

Finally, May 6th, we arrived in San Diego, our first port in California. Five hours we were to stop there. Five hours to see the beautiful city and the collect specimens from the shops. Such wonderful Tourmalines, and Opals, and Turquoise, and dozens of other tempting minerals! How could one choose from so much beauty? One longed for them all. . . .

On again once more, to San Pedro, port of Los Angeles. Then by motor to Sierra Madre, nestling in the foothills of the Sierra Madre Mountains, our new home. Already I am planning some mountain trips for the wonderful specimens that I know can be found there. California surely is the mineralogist's "happy hunting ground." . . .

Another interesting letter, typical of the interest shown in ROCKS AND MINERALS, is as follows:

THE COMMERCIAL MUSEUM,

34th St. below Spruce St.,
Philadelphia, Pa.

MR. PETER ZODAC,
157 Wells St.,
Peekskill, N. Y.

My dear Mr. Zodac:

I enclose, herewith, check covering subscription to ROCKS AND MINERALS.

I want to express my appreciation of the little poem, "The Flint's Lament," by Mrs. Elliott. Without meaning any criticism in the least of the sentiment of the poem, I feel like saying that the flint does not need to lament very much.

The probability is that it is not in a corner "alone and dreary" at all. The industrial uses of flint are many and whole ship-loads of English flint come to the United States. It is used particularly in the pottery industry and for its quality as an abrasive.

I think it rather likely that more flint is used today than in any period in the United States history in the past.

If I knew how to write a poem, I might say some of that to supplement what Mrs. Elliott has written.

Yours very truly,

(Signed) CHARLES R. TOOTHAKER,
Curator.

We have had a letter from one of our subscribers on the Pacific Coast in which he says: "On the Western Coast minerals not subject to much care are liable to tarnish and I have often been asked how to care for them and to keep them bright and showy. I think an article along this line in your magazine by one who knows best how this can be ac-

complished will be much appreciated by our Western brother-collectors."

Will some of our subscribers send us a brief description as to how this can be done for the benefit of their Western brothers who are finding difficulty in preserving the natural beauties of their specimens?

In our last issue we printed a request from one of our subscribers in California for a brief article on tin minerals of the U. S. We are pleased to announce that Charles F. Marble has answered this appeal with an interesting little article on the Rumford tin mine of Maine which appears in this issue. We wish to extend our thanks and appreciation to Mr. Marble for this very kind expression of his interest and desire that ROCKS AND MINERALS may become a popular magazine among mineral collectors.

MINERAL LOCALITIES OF MAINE

By CHARLES F. MARBLE
The Rumford Tin Mine

One of the descendants of the original settlers near Black Mt., in Rumford, Maine, used to tell a story, which he heard from his grandfather. It seems there was, in the old days, a tin mine on Black Mt. Details were lacking but to get to it one had to follow up a certain brook to its source and then keep on going "over the top."

Not so definite as it sounded when the top of the mountain was reached but the story seemed quite honest, in one way, for it did not claim to be fabulously rich like most of these lost mines.

So one day on a prospecting trip the writer headed up that way and by accident found where a tree had been blown over, roots and all, exposing some white rock. On investigation it proved to be Clevelandite and in Maine that is always worth looking at.

The glacial drift covered part of the ledge but there was enough outcrop to show a pegmatitic vein at least 300 feet long and 30 feet wide and with a nearly vertical dip, one part of which was very

rich in Clevelandite. The Clevelandite was stained right through in places with Pyrolusite which had even penetrated into the quartz, giving it what might be called a rough imitation of moss agate. In other places the Clevelandite was fairly rich in Cassiterite (the chief ore of tin) in the form of scattered grains up to three-quarters of an inch in diameter. Many of the Maine pegmatites show an occasional microscopic occurrence of tin but this seemed more liberal.

Other minerals observed were Quartz in large masses, potash Feldspar, Muscovite, Purpurite, Manganapite, and Beryl, both the Aquamarine and Golden Beryl, the Beryl containing some clear sections of possibly gem variety.

Some microscopic crystals, of what appeared to be Beryl on one side of the vein, might have been the result of contact metamorphism.

The deposit is probably not rich enough to work for tin but the clear Beryl and other rare minerals makes it interesting.

FAMOUS MINERAL LOCALITIES OF THE WORLD

The Zeolite Localities of Nova Scotia

By MORRELL G. BIERNBAUM

In the summer of 1924, John S. Frankenstein and Wilford Broadbelt, two well known local mineral enthusiasts, and myself, spent a short time visiting the world-famous Zeolite district of Nova Scotia. We did not have time to visit all the localities, as, to do so, would have required possibly a month and an automobile as well, which latter we did not have. We did, however, visit the better known of the localities, and this article must be necessarily confined to them.

To speak generally, zeolite collecting in Nova Scotia is not an easy matter on account of the comparative inaccessibility of the localities as well as more or less dangerous collecting conditions. The best localities lie on the north shore of Minas Basin, an arm of the Bay of Fundy at the northern end of the bay. The extreme tidal variations of the upper Bay of Fundy are world-famous, and in Minas Basin the tidal differential varies from some 26 feet to an extreme of 62 feet. In the summer, under ordinary conditions, the lower limit is the usual. Accompanying such large tidal variations are strong currents of water, so dangerous, in fact, that boating in small boats is practically impossible in the basin.

The geology of the district is somewhat similar to that around Paterson, N. J., with Diabase flows in Triassic Red Sandstone. Starting on the south shore of Minas Basin, near its meeting of the Bay of Fundy proper, there is a continuous range of some 150 miles extending south abutting the Bay of Fundy. This range is quite similar in appearance to the Palisades formation of the Hudson River, and about the same height. Only the extreme northern tip of this mountain, known as Cape Blomidon, was visited by us. There are several isolated scattered localities along its 150-odd miles, but none of the famous localities is located south of Cape Blomidon. On the north shore of Minas Basin are a series of isolated trap outcrops forming cliffs along the shore, with several small trap islands just off shore having equal precipitous cliffs. It is in this north shore district that the more famous localities are situated. At extreme low

tide, there is a shore below the cliffs, but at half-tide to full tide, it is universal to find the shore completely inundated to a considerable depth, and one must sit out the tide, as it were, on the occasional rock-slides which are to be found, completely marooned temporarily until the tide falls and the shore reappears. There is no such thing as a stone quarry, all mineral specimens being exposed by the yearly frost action cracking away the surface rock and creating rock-slides here and there.

Making temporary headquarters at Parrsboro, on the north shore, the first locality visited was Partridge Island, 3 miles west of Parrsboro. This is only an island at high tide in spring and fall, and is always accessible across a spit of land in summer. This island is the only one we found of which the top is accessible, most of them being vertical cliffs all the way around. The center of the western side of the island is the only section which yielded specimens. The best material found here was fine golden Calcites up to $1\frac{1}{2}$ inches across, brilliant white Heulandite, and large developments of crystallized Stilbite.

Our next locality visited was Wasson's Bluff. We pitched camp on top of a cliff above the shore about a half a mile east of Wasson's Bluff. Wasson's Bluff is quite accessible along shore at low tide. The locality yielded us our best Chabazite (Acadialite), some interesting Gmelinite crystals, some Natronite, Analcite, Heulandite, and Stilbite. The only Mesolite we saw was found here, although we were unable to obtain a specimen.

The next problem was the locality known as Two Islands. These are two trap islands just off shore about a mile east of Wasson's Bluff. The nearer island is the larger of the two. The farther island can only be reached via the nearer island at low tide. The nearer island is about a half a mile from high-tide shore and can only be reached by wading over a rocky bottom through pools of water at extreme low-tide, and the crossing must be made inside of about a half-hour or swimming would be the vogue, so rapidly does the tide

water come back in again. One must then stay out until the next extreme low-tide to get back. The tide turned so fast, that we could not get to the farther smaller island at the same low, and we consequently missed visiting the latter place. On the larger island we found a rock-slide high enough above high-tide to sit it out. We had timed our visit to Two Islands so that we would have low-tide in the morning and evening, so we could "do" the locality in daylight. We found plenty of nicely crystallized individual Gmelinites, Heulandite was also plentiful, while Analcite and Chabazite were fair.

We next headed for what is known as Five Islands. There is a small village called Five Islands on the shore facing the islands. These islands are part trap and part sandstone, and extending in a line diagonally out from shore about 5 miles. Our main objective was Pinnacle Island, the farthest one, this being known as the chief locality there. Pinnacle Rock is an isolated jutting rock which is part of Pinnacle Island at low-tide. These islands are only accessible by boat. We had considerable difficulty locating a boat but finally secured one. We knew that the only time we could go would be on the ebbing tide and drift with the tide.

Now if I may digress for a moment, I would like to advise anyone contemplating visiting Two Islands and Five Islands to time their visits very closely based on the tides. Two Islands must be visited when low tide is in the morning. Five Islands must be visited when high tide is in the morning, just the reverse conditions. If the tide is out at 8 A. M. at Two Islands, it is full at about 2 A. M., too much before daybreak for starting out for Pinnacle Island. If one would attempt to start out at say 5 A. M. for Pinnacle Island under such conditions, the chances of making the island would be slim, as the tide would have turned back again before you could reach the island, and the tidal current here cannot be bucked in a rowboat.

We, not realizing the above previously, had to lay over a day at Five Islands to await a high tide at 4 A. M. We started out at 5 A. M., guided by compass in a fog, and reached Pinnacle Island at about 6:30 A. M., where we stayed until the next turn of the tide was well along. At this locality, we obtained some of our finest material. Natrolite crystal groups were plentiful. The Analcite here was very fine, in good quantities and of fine glassy quality. The Gmelinite was the

finest ever seen by the writer from anywhere, one crystal being found 2 inches across. These are the only three minerals here, but they were very good. We did not have time to visit Long Island, the next one of the group, which, we understood, was also a locality of lesser importance.

The next locality we aimed for was what is known as Amethyst Cove, on Cape Blomidon. To reach this, we went back to Parrsboro, crossed Minas Basin by ferry to Kentville, and hired a machine to take us to Scott's Bay, which lies back of Cape Blomidon. We climbed up the back slope of Cape Blomidon and descended a rather dangerous and precipitous path down the cliff to the shore below, a 400-foot drop. There is only one such path, and one must locate it exactly by inquiring in Scott's Bay. The shore below, for about a mile and a half, presented several isolated mineralized zones, yielding very large Heulandites, Analcites, Stilbites, some Natrolite, quantities of Natrolite pebbles worn round, some greenish Apophyllite crystals of fair quality and size, but rather scarce, very mediocre Amethyst, and masses of an intergrowth of Natrolite-Mesolite.

This was the last locality visited by us, although we would have liked to have gone farther down the bay to Morden, Margaretville, Peter's Point, and other lesser-known localities had we had the time. As before stated, an automobile is essential for this east shore district. The road down the bay parallels the shore about 7 miles back of the mountain, and each shore locality must be visited by a separate trip from the main road.

In resume, it will be evident that mineralizing in this district is largely dependent on the tides. A tide chart is absolutely essential. Besides, collecting here is always dangerous owing to the loose condition of the rock, due to the weathering and frost action. All the mineral veins and pockets are exposed by this action, and every spring brings out a new crop of exposures due to the frost of the previous winter inducing rock-slides and breaking off boulders from the surface of the cliffs. The cliffs are for the most part vertical and sometimes even overhanging, due to the eating away of the lower rock by the water. So, when a boulder gets loose, it usually gives no warning on its way down. For those inclined towards sports, I might add that the swimming is very cold, the water being around 53 degrees in mid-summer.

METAL DISCOVERIES OF ANTIQUITY AND TODAY

By EDWARD CAHEN, A.R.C.Sc., F.I.C., F.C.S.

(Author of "*The Mineralogy of the Rarer Metals*")

Gold, as might have been expected from the fact that it occurs native, was the first of all the metals to be discovered by Neolithic man; and even today this metal still exerts a greater power for good and evil than any other, though there are now plenty of metals which are more rare and more costly. Very pretty and ready to use without any smelting, the metal was too soft for use in the making of weapons, so our primitive forefathers had to look around for something a little harder. Copper was discovered, another native element which required no furnace to obtain it from its ores. This he fashioned into weapons which, though superior perhaps to his crude stone implements, were still on the soft side. From copper to bronze is but a little step, and one that may possibly have been taken by accident, was suggested by the late Professor Gowland. Its discovery may well have been a matter of chance; a lump of copper ore, which nearly always contains some tin, may have formed part of the stones of the fireplace where primitive man was cooking his dinner. The charcoal would melt the ore, reducing the metals and making an alloy which would afterwards be found among the ashes and be seized upon with joy as just the thing from which to fashion fine weapons on account of its superior hardness. Iron was first of all a great rarity, and may even possibly have been of meteoric origin. It was used for ornamental purposes only. Later the Hittites seem to have found out how to smelt it from its ores. In early Egyptian times silver also was known and esteemed nearly as highly as gold. Since these early times in which so few metals were known, some sixty odd metals have been found. In what follows I shall hope to show how many of the amenities of modern life may be traced to the discovery first of all of these metals themselves and then of a use to which to put them. The term "rare metals" does not necessarily imply that but little of them is known to exist, the name is given to them merely to distinguish them from such metals as gold, silver, copper and iron, which are in

every day use. Many of the rare metals exist in vast quantities, titanium for instance, which is so largely used in the steel industry and for coloring artificial teeth to the number of many millions each year.

What usually happens is that a new metal is discovered at first in very small quantities, some peculiar properties which it may possess mark it out for some special use, search is made for more of the metal and more is generally found. In this way the supply keeps pace with the demand. At other times large supplies of one of the rarer metals may be associated with very small quantities of another for which a particular use has already been found; a large and accumulating surplus of the other is thus created, and the problem arises what is to be done with the waste product, a problem which has to be solved by some new discovery.

The gas-mantle industry furnishes by far the best example of both these cases, and particularly the latter. It was discovered by Auer von Welsbach that the oxide of the rare metal thorium, which was found in certain rare minerals from Norway, glowed with a very powerful light when rendered incandescent with heat. Search was therefore made for other minerals containing this metal in quantities large enough to start a new industry. It was not long before the Germans discovered monazite sand on the seashore of Brazil. Monazite is a phosphate of the rare metal cerium and contains about 6 per cent of the wanted thorium. As the gas-mantles contain 99 per cent thorium oxide and only 1 per cent cerium oxide it is obvious that very large quantities of cerium were accumulating as a waste product. What was to be done with it? Auer von Welsbach again came to the rescue and reduced the cerium and other rare metal oxides to metal in the electric furnace thereby obtaining what he termed a mix metal. When this was struck against steel it emitted a shower of bright sparks. In this discovery we have the origin of the countless cigarette lighters which are so common today.

The rare metals have served in another way to make life brighter for us, for the countless electric bulbs which illuminate our houses and offices practically all are composed of metal filaments, which, when rendered incandescent with the current, glow with a very bright light. Tungsten is the metal employed in most of these lamps, though this is by no means exclusively the case. Tungsten, though a rare metal according to our definition, occurs in large quantities throughout the world. In fact in the Cornish tin mines (Cornwall, England) it was a positive nuisance, interfering with the proper smelting of the tin, and more often than not found its way on to the dumps.

Tungsten is also used in enormous quantities in the steel industry for the production of armour plate and other alloys. High speed tools, capable of retaining their temper when white hot, are made from tungsten steel. It has been suggested that in just the same way as Bronze-age man won the victory over Stone-age man so the nation which could command the best supplies of tungsten was bound to win the Great War.

Some thirty or forty years ago vanadium was so rare a metal that it was worth £90 a pound (about \$450). Today a ferro-vanadium containing some 35 per cent vanadium can be purchased for about 30s. a pound (about \$7.50), and considered dear at the price. The reason for this very rapid decline in the value of the metal is the enormous demand created by the elastic properties conferred on the steel by the metal vanadium.

To supply this demand the carnotite beds of Colorado and Utah (U. S.) were discovered and this in turn gave rise to a waste product of considerable commercial importance, namely uranium, another rare metal.

But the story does not end there for where there is uranium there is also radium which still remains the rarest of all the rarer metals, though the discovery of the huge deposits of radio-active ores at Katanga in the Belgian Congo, Africa, has done much to bring the price of radium down to a more reasonable figure.

Second only to radium are the platinum group metals. A century ago a few shillings (50c. or 75c.) would have purchased an ounce of platinum today it is worth more than £40 (about \$200), an

instance of actual rarity keeping the price high. Of this group perhaps the best known after platinum are iridium and osmium, for the tips of fountain pens are made from a natural alloy of these two metals. Then there is palladium which tried to do duty for platinum during the Great War, when this metal was at a premium.

The search for a substitute for platinum led to the use of tantalum, another rare metal, which has been employed with great success in the manufacture of dental instruments, as it does not tarnish or rust, is hard and easily sterilized. In tantalum we have an example of a metal of which there is plenty to be had but for which as yet little use has been found.

From Brazil, the birthplace of monazite sand, comes brazilit, a mineral consisting of nearly pure zirconium oxide from which "zircite" is manufactured. This is probably the best refractory material known. For this reason it finds a use in the manufacture of crucibles, furnaces, and other articles which have to resist the high temperatures which are obtainable today by the use of the electric furnace. It has also been used as a substitute for bismuth in the X-ray photography of the intestines. Together with yttrium, one of the rare earths, zirconium has been used in the construction of the Nernst lamps which used to be a feature of physical laboratories. Zirconium is a typical example of a metal of which there is plentiful supply and for which uses have been found.

There are two or three rare metals, however, for which no use has as yet been discovered, either because they possess no distinctive property or because they really exist in very small quantities. Of these germanium, gallium, and indium may be mentioned. They are also interesting as being illustrative of the way in which a rare metal may be found. Generally speaking a chemist stumbles across a new metal when least expecting it. Sometimes it has been discovered after a deliberate search. Gallium and indium are examples of the last named method, both were predicted by Mendeleeff. Lecoq de Boisbaudran discovered gallium in a blend from the Pyrenees after an extensive examination of many minerals with the spectroscope. Germanium came to light some ten years later in 1855 when Winkler was making an analysis of a new silver mineral and found there was

a uniform shortage of 7 per cent in his analysis. Indium on the other hand was found in 1861 by Reich and Richter by the accidental method. They were examining some blenders from Freiberg, Germany, for the rare metal thallium, discovered originally by Sir William Crookes; they failed to find it but were rewarded for their pains by this discovery of an unknown line in the spectroscope to which they gave the name indium.

Thallium is an example of a very rare metal having found a use owing to its peculiar property of imparting a very high refractive index to glass, making it eminently suitable for optical purposes. The source of supply was found in the flue dust of certain pyrites burners.

Of the importance of these rare metals in our daily life there can be no doubt and this is reflected in the ever increasing literature on the subject.

PHOSPHORESCENCE OF MINERALS

By E. MITCHELL GUNNELL

PART 1—BEING THE INTRODUCTION TO A NON-TECHNICAL SURVEY OF MINERAL LUMINESCENCE.

The collector with an inquiring type of mind should find much of interest in a non-technical study of mineral luminescence. While quite an obscure subject and one seldom met with except in advanced text-books, its multiplicity of beautiful phenomena can, nevertheless, be produced by anyone with the desire and necessary materials. It is this scarcity of non-technical information on phosphorescence that justifies the appearance of a series of papers explaining in everyday language the "hows and whys" of the subject. The writer sincerely hopes, therefore, that these papers will be of use to amateur mineral collectors as a guide in opening up for their pleasure one of the least known and most interesting allied subjects to the science of mineralogy.

Definitions—tedious as they may be—are essential as a foundation upon which to build further knowledge. I will give just as few as possible considering the breadth of the subject to be discussed. Briefly stated, then, *luminescence* is light without heat. This, to the uninitiated, may be a pretty large order right at first, and further explanation is desirable. All our lives we have unconsciously associated together the three words *fire*, *heat*, and *light*. Fire is certainly a source of both heat and light. Now discard the

first word of the trio, *fire*. That gives rise to the question, is there light with heat but without fire? Our electric table lamp furnishes us with an affirmative answer to the query. The glowing bulb is hot, but there is nothing burning within it. Such light accompanied by heat is *incandescence*.

Now we will try discarding the second word of the series, *heat*. That leaves us only the word *light*, and the question is engendered, is there light without heat? The answer is, yes, there is light without heat, or, to be absolutely accurate, there is light with so very little heat that it cannot be measured even by the most delicate devices known. This light without apparent heat is called *luminescence*, *phosphorescence*, or "*cold light*."

Examples of the phenomenon are found in both animal and mineral kingdoms, and are known as organic luminescent bodies, and inorganic phosphors respectively.

Such an example of the first as the phosphorescence of the sea is known to everyone. This beautiful spectacle is caused by the presence of myriads of microscopic animals which give off light by the slow oxidation within themselves of an organic substance called *luciferin*. The light of the common firefly is also

thus explained. But since oxidation is nothing more or less than slow (or fast) burning, the light given off by such luminous animals is not true phosphorescence. Phosphorus, which also glows because of slow oxidation, is similarly mis-classified. Thus we may say that no true examples of the phenomena of luminescence are to be found among living organisms, since "animal light" is always caused by a chemical change accompanied by an appreciable loss of heat energy. However, until a more accurate term is found, "animal light" will be called organic phosphorescence.

Having disposed of the world of the living, we now turn to the world of the inorganic, the world of chemicals and of minerals. Here we find the true phosphors, that is, phosphorescent substances. The oldest and best known chemical phosphor is luminous calcium sulphide, a specially prepared powder formerly sold as "Balmain's luminous paint." This is still a commonly used phosphor—it was discovered in the sixteenth century—and can be procured at a low cost from any chemical dealer. Similarly, the sulphides of zinc, strontium, and barium, specially prepared at a high cost, phosphoresces brilliantly with different colors. Phosphorescent zinc sulphide, formerly called "Sidot's blonde," is of great commercial value today, it being the largest ingredient of the "radium luminous compound" used to make watch and clock dials visible at night. While lack of space forbids a detailed description of how these chemical phosphors are prepared, suffice it to say that the process is both complex and costly, and not always successful even in the finest equipped laboratories. The amateur chemist, without access to an electric furnace, has but little chance of manufacturing a sensitive phosphor in the average home laboratory, despite the claims of popularly written articles.

Enough about chemical phosphors. We are now nearly ready for a detailed discussion of mineral luminescence. A few more definitions, however, are necessary before we can go on with such a discussion. A complete definition of phosphorescence, rather than the mere skeleton of one given at the beginning of the article, is now desirable. Phosphorescence, or luminescence, then, is that phenomenon exhibited by certain inorganic substances

of glowing in the dark without apparent heat after having been exposed to a certain excitant, the emission of light being due to an innate physical property rather than to any chemical change like oxidation. The excitant is anything that excites a phosphor to become luminescent. It may be one of several things, as will be explained directly. This definition of phosphorescence excludes, it will be seen, all luminous living organisms. This is, according to the now-accepted Bohr atomic theory, quite proper, since true phosphorescence can only be caused by atomic motion and never by chemical change. This theory, as it explains phosphorescence, will be explained in detail in a later paper.

For sake of scientific accuracy and convenience, the various luminescent minerals will be discussed as they are classed in groups named after, and determined by, the excitant. There are four distinct types of phosphorescence thus recognized. They are:

- (1) Thermo-luminescence, the excitant being a low heat applied to the phosphor.
- (2) Tribo-luminescence, the excitant being friction applied to the phosphor.
- (3) Electric-luminescence, the excitant being electric discharges of various nature, such as ultra-violet rays, or X-rays.
- (4) Photo-luminescence, the excitant being light rays of non-electrical nature, such as burning magnesium ribbon, or sunlight.

Each of these types of mineral phosphorescence will be discussed in detail in a later article. I will list those minerals which are best examples of each type, giving the locality from which they come, and naming a mineral dealer who can supply collectors with specimens. Each article will also describe how to set up any apparatus for producing a pleasing display from the mineral phosphors, and methods of procedure, suggestions, and ideas, will be given as they seem necessary.

(To be continued)

A COMPILATION OF GEM NAMES

By GILBERT HART

Mr. Hart and "Rocks and Minerals" will be glad to have subscribers send in additional gem stone names not here included or suggestions as to any corrections in names which they believe should be made.

The most beautiful and attractive of minerals seems to possess most of the requirements for their use as personal ornaments; and as such have been used since pre-historic times. Only a comparatively few minerals have thus been singled out for the adornment of man, and these few have been named in many different ways. The rarer minerals are known by their scientific names, which in turn were adopted from the common language of the people. The commoner ones, however, have masqueraded under various names which hide their very commonness and persuade purchasers of their greater value. Similarly very rare types have been given specific names, to accentuate their rareness and their peculiar beauty.

The gathering-together of the many names which have been applied to gems is a task of much interest to the lovers of minerals. Fancy names may hide the very ordinary yellow quartz, or may reveal an unusual stone of great intrinsic value. The present compilation of gem-names was made so that collectors might be saved the troublesome search for the true nature of a cut stone, whose physical and chemical natures are more or less impossible of determination. It represents the result of searching through every source in the English language available to the author. Much credit should be given to the excellent list of similar type which was compiled by W. T. Schaller and published by the U. S. Geological Survey in Mineral Resources of the United States for 1917. Use has been very freely made of this list; in many cases Schaller's concise definitions have been retained complete here. His list has been expanded by additions from many other writers, and forms the base for this.

In addition to the gem names, this compilation includes several names

which have been applied to stones used for ornamental uses, but not for personal adornment. Generally speaking, the line for gems and ornaments is drawn by referring the use of the specimen to personal or other types of ornament. Inclusions of the ornamental stones have been made because of the fact that essentially the same ideals of beauty are necessary for the proper ornamental as for the gem; while such differences as softness, size, and structure truly distinguish the two.

Achirite—diopside, variety from Siberia.

Achmatite—epidote, variety from Achmatovsk, in the Urals.

Achroite—tourmaline, white or colorless.

Actinolite—member of the amphibole group of silicates; monoclinic, usually found massive; color usually various shades of green; hardness, 5 to 6; specific gravity, 3.05; a silicate of calcium, magnesium and iron. Varieties used as gems: **Amianthus**, **Nephrite** (in part), **Jade** (in part), **Smaragdite**, **Smaragdus**, **Strahilitte**.

Adamantine Spar—corundum, hair-brown to grayish smoky brown, by transmitted light may be bluish or greenish.

Adamantine Spinel—spinel, violet.

Adamas—anglicized spelling of the Greek, an old term for diamond used by Pliny, and rarely now.

Adelaide Ruby—pyrope, blood-red variety from South Africa.

Adular—orthoclase, see adularia.

Adularia—orthoclase, transparent, luster often pearly.

Aeroïdes—beryl, pale sky-blue.

Agalmatolite—compact muscovite; (2) compact pyrophyllite; (3) compact steatite; a compact soft mineral, usually greenish white; also called **Fig-**

ure Stone, Image Stone, Lardite, Lard Stone, Pagoda Stone, Pagodite.

Agaphite—turquois, conchoidal variety from Persia.

Agate—chalcedony, finely crystalline quartz. Colors and structure arranged in parallel bands. Following names have been applied to this banded variety of silica: **Agate Jasper**, **Agate Opal**, **Agatized Wood**, **Aleppo Stone**, **Amberine**, **Banded Agate**, **Blood Agate**, **Brecciated Agate**, **Carnelian Agate**, **Carnelian Onyx**, **Ceragite**, **Chalcedony Onyx**, **Chalcedonyx**, **Chinarump**, **Cloudy Agate**, **Clouded Agate**, **Coral Agate**, **Dentritic Agate**, **Eye Agate**, **Eye Stone**, **False Lapis**, **Fancy Agate**, **Fortification Agate**, **Indian Agate**, **Jaspagate**, **Jasponyx**, **Mocha Agate**, **Mocha Pebble**, **Mocha Stone**, **Montana Agate**, **Moss Agate**, **Moss Jasper**, **Myrickite**, **Nicolo**, **Occidental Agate**, **Onicolo**, **Onychite**, **Onyx**, **Onyx Stone**, **Oriental Agate**, **Oriental Onyx**, **Petoskey Agate**, **Rainbow Agate**, **Rainbow Chalcedony**, **Riband Agate**, **Riband Jasper**, **Ribbon Agate**, **Ring Agate**, **River Agate**, **Ruin Agate**, **Ruin Jasper**, **Sardian Onyx**, **Sardian Stone**, **Sardonyx**, **Sardonyx**, **Saturnine Onyx**, **Scenic Agate**, **Scotch Pebble**, **Semicarnelian**, **Shin-arump**, **Striped Agate**, **Striped Jasper**, **Swiss Lapis**, **Texas Agate**, **Tree Agate**, **Tree Stone**, **Wax Agate**, **Wood Agate**. (2) Also used in reference to various other minerals and rocks which occur in layered or banded specimens.

Agate Jasper—variety of quartz, intermediate between agate and jasper, with predominant translucent chalcedony.

Agate Opal—opal, with bands of different colors.

Agatized Wood—wood petrified by cloudy agate which usually retains the structure of wood.

Agrite—calcite, brown or mottled calcareous stone.

Alabandine Ruby—spinel, red or violet tinted.

Alabaster—gypsum, white and fine-grained; (2) aragonite, pure white, fine-grained stalactites; (3) calcite, pure white, fine-grained.

Alabaster Coral—alabaster, aragonite variety, digested and stained in imi-

tation of coral.

Alabaster Stone—calcite stalactites or travertine.

Alalite—diopside, colorless to green.

Alaska Diamond—quartz, rock crystal.

Albite—member of the feldspar group of silicates; triclinic, usually massive; color usually white to pale shades of red or green; hardness 6, specific gravity 2.62; silicate of sodium, aluminum. The following gems have been named: **Albite Moonstone**, **Aventurine Albite**, **Aventurine Feldspar**, **Cleavelandite**, **Moonstone Albite**, **Peristerite**, **Perthite**.

Albite Moonstone—albite, iridescent.

Alencon Diamond—quartz, rock crystal from Alencon, France.

Allepoo Stone—eye agate, variety of quartz.

Alexandrite—chrysoberyl, emerald to dark green; in artificial light changes color to columbine red.

Algerian Onyx—alabaster, aragonite variety.

Allanite—monoclinic, massive; color usually brown to black; hardness 5.5 to 6, specific gravity 4.2; complex silicate of calcium, iron, aluminum and the rare earths.

Allochroite—andradite, brown to reddish brown, fine-grained.

Almandine—alternate spelling of almandite.

Almandine Spinel—spinel, violet-red.

Almandite—member of garnet group of silicates; isometric, usually in trapezohedral crystals; color usually red of various shades; hardness 7 to 7.5, specific gravity 4.15; silicate of iron and aluminum. The following varieties have been named: **Almandine**, **Almond Stone**, **Cape Garnet**, **Carbuncle**, **Ceylon Ruby**, **Oriental Garnet**, **Precious Garnet**, **Syrian Garnet**, **Vermeille**.

Almond Stone—almandite, brown.

Alpine Diamond—pyrite.

Amatrice—variscite, green through blue-green to blue, usually cut with the matrix.

Amazonite—microcline, amazonstone.

Amazon Stone—microcline, green.

Amber—a fossil resin; hardness 2 to 2.5, specific gravity about 1.10; yellow to red; a complex hydrocarbon,

with oxygen and possibly nitrogen; also used as gem in following varieties: **Ambrite**, **Ambroid**, **Burmite**, **Simetite**, **Succinite**, **Vegetable Fossil**.

Amberine—agate, yellowish green, from Death Valley, Cal.

Amber Agate—same as amberine.

Amber Opal—opal colored brownish-yellow by iron oxide.

Ambrite—amber, colored yellow-gray with greasy luster.

Ambroid—amber, small pieces fused together by heat and pressure.

American Jade—vesuvianite, californite variety.

American Ruby—garnet, usually pyrope of blood-red color.

Amethyste Basaltine—beryl, pale violet to reddish.

Amethyste Orientale—corundum, French translation of oriental amethyst, which see.

Amethyst—quartz, in crystals of purple to bluish violet color; transparent; by some applied to stones of any color which show a rippled fracture due to irregular twining of right and left hand individuals.

Amethystine Quartz—quartz, of amethyst color, but may not be in crystals as amethyst, but may occur massive.

Amianthus—Actinolite, fine silky variety of actinolite asbestos.

Amphibole—name of a group of silicate minerals, which crystallize in the orthorhombic, monoclinic or triclinic systems; hardness usually 5 to 6, specific gravity 3 to 3.3; general formula is $RSiO_3$, where R is usually Ca, Mg or Fe, but may be alkalies or earths.

Amphodelite—an old term for anorthite.

Anatase—octahedrite; this is the preferred name in England, while octahedrite is preferred in America for the mineral, gems seem to use anatase in either country.

ANCONA RUBY—quartz, red to pink.

Andalusite—orthorhombic, usually massive; colors red to green; hardness 7.5, specific gravity 3.18; a silicate of aluminum; varieties used as gems: **Chiastolite**, **Cross-stone**, **Crucite**, **Hollow Spar**, **Macle**. (2) Sometimes used as a trade name for tourmaline gems.

Andesine—member of the feldspar group of silicates; triclinic, usually massive; pale-colored; hardness 6, specific gravity 2.69; one of the plagioclase mixtures of albite and anorthite.

Andradite—member of the garnet group of silicates; isometric, usually in dodecahedrons; color from yellow to greens; hardness 7, specific gravity 3.85; silicate of calcium and iron; gem varieties: **Allochroite**, **Anthrax**, **Aplome**, **Black Garnet**, **Bredbergite**, **Calderite**, **Colophonite**, **Demantoid**, **Jellettite**, **Melanite**, **Haplome**, **Polyadelphite**, **Pyreneite**, **Rothofsite**, **Tazapozite**, **Uralian Emerald**.

Anhydrite—orthorhombic, usually massive; pale to colorless; hardness 3 to 3.5, specific gravity 2.99; calcium sulphate, anhydrous; gem varieties: **Muriacite**, **Tripestone**, **Vulpinite**.

Ankerite—hexagonal, habit rhombohedral; usually brown to pale brownish white; hardness 3.5 to 4, specific gravity 3.00; calcium carbonate with magnesium, manganese, and iron; also called Brown Spar.

Anorthite—member of feldspar group of silicates; triclinic, usually massive; colorless; hardness 6, specific gravity 2.75; silicate of calcium and aluminum; also known as **Amphodelite**, **Biotine**, **Christianite**, **Cyclopite**, **Indianite**, **Latrobite**, **Lepolite**, **Thiosauite**.

Anthracite—a rock, commonly called hard coal, iron-black in color and takes a fine polish.

Anthrax—an ancient name whose original significance is not fully known, has been applied to sapphire and to carbuncle.

Antozone—see next below.

Antozonite—fluorite, dark violet blue.

Apatite—hexagonal, habit massive; usually green to blue or brown; hardness 5, specific gravity 3.15; phosphate of calcium with fluorine or chlorine; gem varieties: **Asparagus Stone**, **Bone Phosphate**, **Eupyrchroite**, **Francolite**, **Lasurapatite**, **Moroxite**.

Aphrizite—tourmaline, black.

Aplome—andradite, dark brown to brownish green to yellowish green.

Apophyllite—member of the zeolite group of silicates; tetragonal, massive or tabular; white or pale reds

or yellows; hardness 4.5 to 5, specific gravity 2.35; hydrous silicate of potassium and calcium; also known in gem variety as Fish Eye Stone, Ichthyophthalmit.

Apricotine—quartz, yellowish-red pebbles from Cape May, N. J.

Apyrote—corundum, sapphire.

Aquamarine—beryl, light bluish-green to sea-green.

Aquamarine Chrysolite—beryl, greenish-yellow.

Aquamarine Topaz—topaz, greenish.

Aragonite—orthorhombic, usually acicular or massive; colorless or pale colors; hardness 3.5 to 4, specific gravity 2.95; calcium carbonate; gem varieties: Alabaster, Algerian Onyx, California Onyx, Coralloidal Aragonite, Flos Ferri, Flowers of Iron, Iztac Chalchihuitl, Mexican Onyx, Mosaic Agate, Oriental Alabaster, Oriental Onyx, Ruin Aragonite, Satin Spar.

Arendalite—epidote, dark green.

Argentine—calcite, pearly with lamellar structure, white to yellowish.

Arizona Ruby—pyrope, deep red, from Arizona or Utah; (2) quartz, ruby red, from Arizona.

Arizona Spinel—pyrope, deep red, from Arizona or Utah.

Arkansas Diamond—diamond, from Arkansas; (2) quartz, rock crystal from Arkansas.

Arkansite—brookite, brilliant iron-black, opaque.

Armenian Stone—lapis lazuli; (2) corundum, blue and translucent; (3) azurite.

Armenite—lapis lazuli.

Arrow Points—Indian arrow heads, usually quartz, also obsidian.

Asparagus Stone—apatite, pale yellow.

Asteria—corundum, asteriated; (2) any gem showing a six-rayed star when cut cabochon.

Asteriated Quartz—quartz with whitish or colored radiations within the gem.

Asteriated Sapphire—corundum, asteria.

Asteriated Topaz—corundum, yellow; equals an asteriated oriental topaz.

Asterie—corundum, asteria.

Australian Sapphire—corundum, deep inky blue.

Automolite—gahnite, dark green to nearly black.

Avanturine—alternate spelling of avenirite adopted by some English writers.

Aventurine—quartz, opaque, yellow brown or red scales contained in the massive mineral showing a vivid spangled appearance; (2) applied to many other gems, usually with a descriptive term, which are found with similar inclusions.

Aventurine Albite—albite, sunstone.

Aventurine Feldspar—feldspar containing inclusions which spangle, most is orthoclase but rarely albite or oligoclase.

Aventurine Oligoclase—Oligoclase, white to gray with internal red to yellow reflections due to disseminated goethite.

Aventurine Orthoclase—orthoclase, sunstone.

Aventurine Quartz—see Aventurine.

Axinite—triclinic, massive; usually brownish; hardness 6.5 to 7, specific gravity 3.29; complex borosilicate; also called Yanolite.

Axstone—nephrite.

Azomite—zircon.

Aztec Stone—see chalchihuitl.

Azulite—smithsonite, pale blue.

Azure Quartz—quartz, blue, really a silicified crocidolite.

Azure Spar—azurite.

Azure Stone—lapis lazuli.

Azurite—monoclinic, massive; various shades of vivid blue; hardness 3.5 to 4, specific gravity 3.77; hydrous silicate of copper; used as ornamental stone under the following names: **Azure Spar**, **Azurite-malachite**, **Azur-matachite**, **Blue Malachite**, **Chessy Copper**, **Chessylite**.

Azurite-malachite—see azurmalachite.

Azurmalachite—mixture of azurite and malachite from Arizona.

ARRANGING THE MINERAL COLLECTION

By JOHN MELHASE

Berkeley, Calif.

The size and arrangement of a mineral collection is largely a matter of individual taste and reflects the whims or desires of the collector himself. There are a great many collections, however, that are limited in size to conform to cabinet space available or to the time and money necessary to secure the specimens. Advanced collectors, as a rule, prefer specimens of considerable size and when these are displayed in the usual types of showcases or wall cabinets a great deal of space is needed. In fact many collectors have special rooms devoted to the display of their specimens and I have yet to see one who did not feel that he had insufficient space for the purpose.

Some collectors who are desirous of having a complete type collection which at the same time will occupy a minimum of space have hit upon the expedient of collecting microscopic specimens, that is, specimens in which the mineral is developed in microscopic crystals. Such specimens are usually not over $2\frac{1}{2}$ centimeters (1 inch) in greatest dimension and consist preferably of a piece of matrix surrounding small cavities or vugs in which minute crystals have formed. These specimens are mounted in individual black cardboard boxes about an inch square and are then arranged according to Dana's classification in a cabinet of small drawers. With this method a complete type collection will occupy not over two square feet of floor space.

A collection of this kind, however, possesses one serious fault which makes it undesirable for the average collector and that is the obvious fact that the specimens cannot be viewed and enjoyed with the unaided eye. They must be placed beneath a specially constructed binocular microscope in strong reflected light, but when this is done the minute crystals are brought out in amazing beauty and perfection, wholly unattainable in crystals of macroscopic size, since these, because of their greater size, are invariably broken, deformed, or discolored.

The great majority of mineral collectors, however, are not so happily situ-

ated as to be able to acquire complete type collections of museum size specimens or even those of hand size, yet the tendency of most collectors is to acquire the better crystallized specimens in the smaller sizes, thereby sacrificing quantity for quality, a practice not wholly without merit. A great many rare minerals occur in most unattractive masses which are unsatisfactory for display purposes yet very essential to the type collection and some collectors who aim to arrange collections pleasing to the eye will have nothing to do with the massive minerals of somber colors.

The desire for showy specimens often overshadows all other considerations in the selection of minerals and apropos of this assertion the story is told of a beginner who desired to start a mineral collection, but who knew practically nothing about minerals. He entered the shop of a dealer in minerals and selected a large number of the most showy specimens in stock, thinking no doubt, that he was securing all different species. Imagine his astonishment when a friend, better versed in mineralogy, inspected the selection and informed him that they were all different varieties of the one mineral, Quartz.

The writer, having been confronted with the usual obstacles to be overcome in the selection and arrangement of a mineral collection, has hit upon a scheme which combines many of the advantages of the show collections with those of the scientific ones and permits the use of various sized specimens, not however, without a certain unavoidable duplication of species.

This collection is divided into three sections as follows: (a) the show specimens, (b) the type collections, and (c) the crystal collection.

The show collection consists of specimens averaging hand size or larger selected chiefly for their beauty of color and crystallization. These are arranged in a built-in wall cabinet which occupies one entire side of the room and is enclosed by sliding plate-glass doors which permit ready access to the specimens.

when necessary. Within the cabinet are plate-glass shelves covered with felt of a neutral or pearl-gray color upon which the specimens rest. Each shelf accommodates two rows of specimens, the rear row being raised about three inches by means of a false shelf so that an unobstructed view is assured. The higher shelves are set with a forward inclination which permits an observer at the center of the room to see every specimen in the cabinet. Printed cardboard labels giving the name, composition, locality, and other pertinent data are fastened to the false shelf and to the back of the cabinet immediately above each specimen and secured in place by means of tiny copper escutcheon pins.

The type collection is arranged in an oak cabinet which occupies a space two by four feet and is three and one-half feet high. It consists of twenty drawers each 19 by 22 inches by $2\frac{1}{2}$ inches deep. In the top of the cabinet is a recess lined with black velvet and covered with a glass plate 24 by 45 inches which forms a dust-proof showcase for delicate crystallizations which must not be handled. The total capacity of this cabinet is over three thousand specimens of the particular size selected for the type collection.

This collection is arranged according to Dana's System of Mineralogy. Each specimen is under $1\frac{1}{2}$ inches in greatest dimension and is mounted in a shell vial of thin glass $1\frac{1}{2}$ by 2 inches and tightly corked. A pad of white cotton is firmly pressed between the cork and specimen thus holding it securely against the closed end of the vial. A gummed label with the name, number, composition, locality, etc., is fastened to the vial and the specimen is then assigned to its proper place in the cabinet. In order to prevent the jostling about of the vials when the drawers are opened, each drawer is partitioned off into cells by means of heavy pasteboard strips one inch wide running the full length and width of the drawers. These strips are notched at regular intervals by means of a coarse hand saw so that they dovetail together to form a series of uniform cells $1\frac{1}{2}$ inches square and one inch deep into which the vials snugly fit. With this arrangement every specimen is in full view through the top and sides of the vial. Delicate crystallizations are perfectly protected and if

the mineral is one that may absorb moisture from the air a little melted paraffine poured over the cork will effectually seal it. In this collection both the massive and the crystallized forms of the mineral are represented where possible and also the different varieties of the species so far as obtainable.

The crystal collection is mounted in the same manner as the type collection except that the vials used are 1 by 2 inches in size and may be made by cutting off the closed end of a 1-inch test tube.

The crystals for this collection are selected for perfection of symmetry and for the different forms represented. Pyrite for example, will furnish the cube, the octahedron, the pyritohedron, and the various combinations of these faces, all of which must be taken into account. Duplication of the crystal form will occur in numerous species. In the writer's collection the octahedron for instance, is exhibited by diamond, gold, pyrite, magnetite, hauerite, senarmontite, and many others. These crystals are arranged according to the six systems of crystallography and the various classes of symmetry. They are labelled according to system and class, the principal faces noted, and the name and locality given. When possible, the crystal is given its proper orientation in mounting, but occasionally the size of the vial will not permit this and the crystal must be turned so it will fit the vial.

Perhaps a few words of caution to the young collector will not be amiss. In the first place, do not put a specimen in your collection without a proper label and identification number, and the latter securely affixed to the specimen. Do not move or re-arrange your specimens more often than necessary. Crystallized specimens will depreciate in value through breakage every time they are handled. Frequently a thoughtless visitor will deliberately break off a piece of your most cherished specimen in order to see what it is made of. Do not expose silver minerals such as cerargyrite, pyrargyrite, iodyrite, etc., to a strong light as they will darken rapidly. Do not keep native silver or native copper specimens in the

proximity of sulphide minerals as they will tarnish and blacken unless protected by a thin coating of shellac or water glass. Delicate crystallizations must also be protected from dust and for this purpose the writer uses shell vials and small glass-topped boxes. Above all, do not clutter up your mineral collection with arrow heads, old coins, or other

curios. These are all right in their place, but not in a mineral cabinet. I have seen mineral collections that contained everything from a mummy to a photograph of a notorious lynching scene and there is nothing so disgusting to a lover of minerals as to see them defamed by association with such trash.

COLLECTING IN OREGON AND IDAHO

By H. C. DAKE

Accompanied by friend wife, the writer left Portland, Oreg., by auto in July, over the famed Columbia River Highway, with the chalcedony fields at Antelope, Oreg., as our first stopping place. At this locality are to be found an abundance of quartz and calcite crystal lined geodes. The surrounding country is a series of low rolling sage brush covered hills, and the geodes are found lying loose, having been weathered out of the covering of Columbia River basalt (Miocene age) which covers a large part of central Oregon. The geodes occur in sizes ranging from quite small up to a foot or more in diameter. It is from this locality that much of the "Newport Agate Beach" chalcedony is obtained.

Upon leaving Antelope we proceeded eastward via the scenic John Day Highway to Dayville, Oreg., near by a vein of Cinnabar, within sight of the highway, calls for attention, due to its striking color. The road then leads through many miles of the noted fossil beds of the John Day river basin. Many important faunal finds have been made here by scientific parties which visit this locality frequently. The beds range in age from Eocene to Pleistocene and present a gorgeous color scheme of fascinating beauty.

Calcite is abundant in the sedimentary beds.

Our next place of call was at the old Standard mine north of Prairie City, Oreg., which was at one time a heavy producer of Cobalt and Copper and is now being further developed. Fine specimens of Cobaltite, Smaltite, Safflorite, Erythrite, Chalcopyrite, Calcite and Pyrite were obtained from the old workings. Chromite and Serpentine is also available in this locality. The surrounding country is quite mountainous and many quartz gold mines can be visited near at hand.

Continuing eastward, a side trip to the old mining camp of Sumpter, Oreg., netted a specimen of Iridosmine from the placer operations. Very few of the mines in this locality are active and the material on the old dumps is of no special interest. Passing on into Owyhee County, Idaho, via the Old Oregon Trail, we turned south toward the famous old mining camp of Silver City, Idaho. This camp is reached by a fairly good auto road which is quite steep and narrow requiring cautious driving. This town, which at the time of its most feverish activity in 1875 boasted a population of over 5,000, now has only a small popula-

tion. Silver City was a producer of fabulous wealth in silver and gold, and it is said that the Poorman mine located here was the richest silver mine ever known for its size. The camp lies at an elevation of over 6,000 feet in a rather mountainous region. The country rock is a huge granite batholith and the mines are all on contacts and fissures veins in the granite. Silver City is truly a mecca for the collector and he or anyone interested in mining or minerals will receive a welcome in the true western fashion. Packing in the material gathered will be the only problem to confront one. In addition to the interesting minerals to be found here, the town itself is fascinating for its history and antiquity.

Our first point of interest in this locality was War Eagle mountain, a few miles from town where many old mine dumps afford excellent specimen material. The Poorman mine, noted for its very rich and rare silver ores, is located near the summit of this mountain. The ores found on this mountain contain the common silver minerals; Argentite, Pyrargyrite, Proustite, Stephanite, and also the following rarer minerals: Naumannite (abundant), Owyheeite, and Pyrostilpnite. Very fine and large masses of Cerargyrite were taken from the early surface workings, but this material is not now abundant. Fine Quartz crystals are found in practically all the mines, since the gangue material is largely quartz.

A short distance west of Silver City, the Trade Dollar, Banner and Alpine veins, located on Florida mountain, are being operated by the Empire Mines Company. Many fine minerals are available here and collectors will find the management very cordial. The above veins have been worked and developed extensively and have produced many millions in gold and silver. The gold found at the Florida mountain workings is all naturally alloyed with about equal parts of silver to form Electrum. Jamesonite and the rare lead selenide, Clausthalite, are found in the Trade Dollar vein. Much of the "ruby silver" taken from the early workings on these properties was the dark ruby silver,

Miargyrite. The silver selenide, Naumannite, is abundant in the ores of Florida mountain. The gangue minerals of these veins are especially interesting to the collector and mineralogist since there is an abundance of well crystallized and unusual material present. Finely crystallized Quartz, an unique cellular Calcite, and the unusual Orthoclase var. Valencianite, are found in the vein vugs. The Valencianite is unusual in that it is a product of direct solution deposition, while the usual orthoclase genesis is directly from the molten magma. Many specimens of this Orthoclase, having well developed crystals nearly an inch in size, can be found in the milling ore and often on the mine dumps. Some of the Valencianite crystals are covered with a fine coating of drusy Quartz and with inclusions and coatings of silver minerals.

The Quartz in the Alpine and Banner veins occurs in two interesting forms, nearly perfect doubly terminated crystals and a peculiar pseudomorphic or "cellular" Quartz. The latter form is quite unique and peculiar to the Silver City district. It occurs in thin plates or sections from a fraction of an inch to more than two inches in size, which intersect and join in a variety of but no predominating angles, in such a manner as to produce a cellular or box-like structure. The plates are not portions of a crystal, nor do they represent developments of Quartz along cleavage planes of a previously existing mineral. No mineral could be arranged in groups so that its cleavage planes could intersect each other in such a manner. It is obvious that the plates do not represent an original deposition of Quartz, but are pseudomorphous after some previously existing mineral, the identity of which is not clear. A cellular Calcite is found in the Alpine and Banner veins which resembles the general outline of the cellular Quartz and it is assumed that the cellular Quartz is a pseudomorph after the cellular Calcite.

Shannon's "Minerals of Idaho" and the Idaho Bureau of Mines Bulletin No. 11, give excellent descriptions of this region, and it is recommended that a collector contemplating a journey to this mecca should secure these publications.

NOTES AND NEWS OF MINERALS OF THE RARER ELEMENTS

By O. IVAN LEE.

Mr. Lee will be glad to assist subscribers in identifying specimens suspected of being minerals of the rarer metals or in answering questions pertaining to them. Please write to him direct, enclosing postage if a personal reply is desired, specimens returned, etc. Address all mail as follows: O. Ivan Lee, 2084 Boulevard, Jersey City, N. J.

GERMANIUM AND ITS OCCURRENCE.

The element Germanium is an extremely scarce one, and the native metal is quite unknown. The spectroscope indicates its presence in the sun, however, and it has been suggested that it may be more widely distributed in the earth's crust than is generally supposed inasmuch as there is no characteristic and delicate test known for it. Even chemical microscopy as yet has offered no ready means of its identification. One chemist examined 64 specimens of Zinc Blendes and found germanium present in 38 of them; another tested 68 samples of the same ore and 50 of these gave positive results. From this it would appear that two out of three Sphalerites may contain traces of germanium. Those from Webb City, Mo.; Stolberg, Aix-la-Chapelle; Turkey in Europe; Raible, Corinth and Mexico contained appreciable amounts. It has also been reported from Kentucky Smithsonite and zinc ores from Idaho, Colorado, Nevada and Utah.

Teallite (Pufahlite) is said to contain 0.2 per cent of germanium; and *Franckeite*, $5\text{PbS} \cdot \text{Sb}_2 \text{S}_5 \cdot 2\text{SnS}_2$ was found to have about 0.10 per cent, and *Euxenite* has yielded a similar quantity. Minute percentages have also been reported in tantalum and columbium minerals such as *Tantalite* (0.01 per cent); *Columbite* and *Fergusonite* (0.03 per cent), and *Gadolinite*, a silicate of yttrium, beryllium and iron, contains a trace. Its occurrence in *Samarskite*, however, has been disputed. Certain *Cassiterites* have likewise shown evidence of germanium, and a zinc oxide and spelter originating from Missouri and Wisconsin ores showed 0.25 per cent of the elusive element.

The first mineral known in which germanium plays the part of an essential

constituent, and in which, in fact, this element was originally discovered, is the famous *Argyrodite*. As the name implies, it is a silver-bearing mineral and resembles Stibnite in appearance albeit with a tendency to a reddish cast. It may carry from 4.99 to 7.05 per cent of germanium, and its composition may best be shown by the formula $4\text{Ag}_2 \text{S} \cdot \text{GeS}_2$. The newest analysis gives the following composition.

Composition of Argyrodite	
Copper	0.08%
Zinc	0.11%
Iron	0.03%
Silver	75.67%
Mercury	0.03%
Germanium	6.55%
	82.47%
	99.95%

Argyrodite has been found only in Bolivia and Germany.

The variety *Canfieldite* is looked upon as *silver sulfostannate*, $\text{Ag}_8 \text{SnS}_6$, mixed with the isomorphous *sulfogermanite*, $\text{Ag}_8 \text{GeS}_6$, tin and germanium belonging to the same chemical group. It contains about 1.82 per cent of germanium, analysis showing the following composition.

Composition of Canfieldite	
Iron, Zinc ..	0.21%
Silver	74.10%
Tin	6.94%
	81.25%
	81.25%
	18.04%
	99.29%

More recently, a mineral of a dark reddish-gray color indistinguishable in appearance from *Luzonite*, has been discovered at Tsumeb, South West Africa. It is known as *Germanite* and the formula

approaches $Cu_5 (Cu,Fe)_6 AsGeS_{12}$ or perhaps $10Cu_2 S_4GeS_2 As_2 S_3$. Analysis of a selected piece reveals no less than 20 elements.

Composition of Germanite

Copper	45.39 %	Titanium	
Lead	0.66 %	Oxide	0.004%
Zinc	2.58 %	Molyb-	
Iron	4.56 %	denum	1.282%
Germanium	8.70 %	Manganese	0.020%
Arsenic	4.13 %	Nickel	0.001%
Sulfur	30.65 %	Cobalt	0.013%
Gallium	0.76 %	Cadmium	0.071%
Silica	0.226%	Lime	0.122%
Tungstic		Magnesia	0.055%
Oxide	0.184%	Carbon	0.136%
	97.840%		1.704%
			97.840%
			99.544%

The black mineral *Ultrabasite* found in the Himmelsfürst mine, Freiberg, Saxony, Germany, is stated to be *silver germanium sulfoantimonite*, $11Ag_2 S_28Pb_3GeS_2.2Sb_2 S_3$, and is possibly a mixture of lead germanium sulfide, $3GePb_2 S_4$, with $2Pb_3 (SbS_3)_{2.16}PbS$, and $11Ag_2 S$.

A well known American chemist told the author about four years ago that he had discovered a rich source of germanium in Utah. Unfortunately, however, the sample in which it was found was about twenty years old, and could not be traced to its source, and the possibility arose that the mine had been worked out as the product had been used for copper smelting. Thus ended the trail of the "lost germanium mine."

MINERAL LOCALITIES OF CONNECTICUT

By FREDERICK S. EATON,

Professor of Botany, Connecticut College of Pharmacy

Laumontite and Specular Hematite from Mill Rock, New Haven

The old Laumontite source on Mill Rock was said to have been exhausted some thirty years ago. The writer, however, needing specimens for his collection, re-opened the workings securing a quantity of flesh-colored, friable, crystalline vein Laumontite.

In describing any mineral locality fully as much space should properly be devoted to the accurate geography and "renseignements" of the location as to the minerals themselves. In only a very few cases such information need purposely be hidden.

Mill Rock is an intrusive trap eminence, three-quarters of a mile in length, projecting up through the red sandstone floor of the old Connecticut Valley. This intrusive sheet runs in an east and west direction and forms a natural north boundary to the city of New Haven. The locality under discussion is on the exposed and quarried west face of the rock at the end of Winchester Avenue but three minutes walk along a sandy road from the end of the Winchester trolley-car line. (Cars every twelve minutes from center of city.)

Laumontite was found by breaking away weathering trap along natural, rusty, nearly vertical seams. It was necessary to go about eighteen inches into fairly sound rock to secure material that did not disintegrate at the touch. This quarrying operation was fairly simple as the rock has frost cleavages extending far beyond the writer's burrowings.

Specular Hematite was found on the sandstone at the southeastern contact of the sedimentary and igneous rocks. Here the sandstone was baked and had lost its red color, appearing very like the trap. Small shiny crystals covered the sandstone face nearly completely.

Garnet is also reported from this same spot but it has not been the writer's privilege to find any crystals large enough to see without a hand lens.

Calcite Possessing Perfect Rhombic Cleavage from Blakeslee Quarry, Arlingtontown

Arlingtontown is a western suburb of New Haven. The Calcite is found above the level floor, on the western face of a trap quarry operated by Blakeslee & Co., New Haven contractors.

This quarry may be reached by taking a Campbell Avenue-West Haven or Congress Avenue car (car every fifteen minutes from center of city) to corner of Forest Street, Campbell Avenue, and Milford Turnpike (Boston Post Road) and walking west, up a hill along the Post Road one-quarter of a mile. The quarry lies directly on the north side of the highway, visible from the road, on the flat top of the hill.

Here pure white Calcite may be obtained, which breaks with a perfect rhombic cleavage. This locality consists, as far as the writer can calculate, of a massive geode or replacement cavity where trap has been replaced by calcite deposited from waters running through seams in the rock. No similar structure is described in any of the literature examined. Minute flecks of Chalcopyrite are sometimes found in the Calcite and native Copper is reported from within a few hundred feet of this spot.

Of interest to historians is a copper mine somewhere in this immediate vicinity, from which two ship loads of ore were sent to England for smelting in Colonial times. Diligent search on the part of Messrs. Alfred Hammer and Warren Mumford, of Branford, Conn., (both ardent mineralogists) and the writer, has failed to uncover this working.

Prehnite and Copper-Associates from Powder Hill Quarry, Mill Rock, New Haven

We return to the trap eminence first described in the present article. The Powder House Quarry, named from its proximity to the site of a Revolutionary magazine, lies at the end of Prospect Street (continuation of College Street) near to the eastern point of Mill Rock.

This working, now much overgrown with shrubbery, is within ten minutes' stroll of the Laumontite locality or may be reached from the Whitney Avenue car line (cars every six minutes from center of city) by leaving car at Armory Street and walking westward past the filtration plant until the quarried south face of Mill Rock appears on the right hand.

Here excellent rounded masses of Prehnite may be found on the talus and up on the quarry face. Small and poor specimens of Bornite, Cuprite, and Malachite, may also be found. The collector in search of these last should journey to Copper Valley and the Barites mines of Cheshire (to be described in a succeeding article) for good specimens.

(To be continued.)

PALEONTOLOGY DEPARTMENT

Conducted by
BENJAMIN T. DIAMOND, B.S.

Mr. Diamond will gladly assist subscribers in identifying their fossil specimens or answering any questions pertaining to fossils. Please write to him direct, enclosing enough postage if a personal reply is desired, specimens returned, etc. Address all mail as follows: Benjamin T. Diamond, B.S., 467 Riverdale Ave., Brooklyn, N. Y.

FORAMINIFERA

Since 1917 Micropaleontology, mainly the study of Foraminifera has been successfully applied to the determination of strata and identification of horizons in the solution of geological problems in the oil fields.

Plancus (Bianci) began the study of Foraminifera in 1731. The species which he described were named by Linnaeus in his *Systema, Naturae* in 1758. Until 1835 Foraminifera were considered to be minute Mollusca (Pelecypods and Gastropods) by the different students of

these: Walker and Boys (1784), Batch (1791) named sixteen species, Brugere (1789), Lamark (1801), DeMontfort (1808), DeFrance (1824).

DeMontfort in 1830 divided them into univalves and bivalves but it was left for a youth of seventeen, D'Orbigny to see the difference between the Foraminifera and the Mollusca. In 1826 he published his first work on Foraminifera in which he showed that while the chambers of the Gastropods were connected by a tube (siphuncle) the Foraminifera simply had a hole (foramen) in each septa. He therefore divided them into two groups, the siphonifera and the foraminifera. He made models of the latter which were so perfect that they are used today. He recognized all the specimens that Lamarck named.

In 1835 Dujardin noted in two forms that there were fine threads coming out from the aperture and reticulating. These he called Rhizopoda and said that the Foraminifera belonged to this group.

In 1839 three important volumes were published—The Foraminifera of Bolivia, Cuba and of the Cretaceous of Canary.

Williamson (1858) wrote a volume on the Foraminifera around Great Britain in which he took issue with D'Orbigny by introducing varieties. He enunciated the idea that Foraminifera vary enormously so that species are hard to recognize.

Carpenter (1862) in his "Introduction to Foraminifera" repeated Williamson's ideas and added the idea that the genera merge into families, and that the families merge into orders. This idea came at the same time as the evolution theory.

In 1884 Brady in his "Challenger Report" names, describes, indicates, and pictures a great number of Foraminifera.

The period from 1922 to the present time is known as the period of "Application of Paleontology" in determination of ages and fine differentiation between genera and species.

Probably no branch of natural history has received more intensive study during the past ten years than the microscopic fossils which have proved of such great value in the determination of under-

ground structures, particularly in oil geology.

Correlation is desired in general:

1. Between continents.
2. Between different stratigraphic provinces in the same continent.
3. In the same stratigraphic province, when you desire to determine the geologic formation of a formation.
4. Of horizons in a small area, as an oil pool, to determine the exact equivalence or identity of horizons.

There is no doubt that organic remains (Paleontology) are by far the better criteria for use in correlation than are inorganic substances (Lithology).

Index fossils—those whose range and abundance is known, such as *Orbiculina adunca* Recent, *Lepidocyclus mantelli* Vicksburg, *Fusulina secalica* Pennsylvanian or Permian, *Calcsphaera robusta* Onondago, etc.

Guide fossils—those which have a restricted range and which occur frequently, such as *Endothyra baileyi*, Salem limestone Mississippian.

Sequence of faunas—when two or more faunas are found in succeeding horizons and can be compared with other like sequences there is a great probability of the identity of sequences.

General faunal aspect—when three or four specimens are found, all belonging to one horizon, it sometimes is sufficient to establish the horizon. For instance, if *Orbulina universa*, *Globigerina bulloides* and *Lepidocyclus mantelli* were found, it would be sufficient to establish the horizon as the Oligocene.

Foraminifera are just as reliable as any other group of fossils for correlation. These, however, have the additional advantage of occurring in larger numbers, both as to species and specimens than any other kind of fossils. Because of their size, they are not broken in drilling and can be identified from the outside.

Because of the advantages of Foraminifera in correlation, they have become the most important fossils of the present and are receiving more attention than any other fossils.

THE BEGINNER'S CABINET

A Department for Young Collectors

Conducted by
ILSIEN NATHALIE GAYLORD

THE STORY OF OLD GOLD

Ice and snow and frozen earth! No collecting trips now for those of us who live where winter holds the earth in its grip. However, that need not hinder us from studying the specimens all around us. For instance, that gold ring on your finger, or that gold coin.

All sorts of amazing things that ring of yours can tell us. Suppose the gold in it were stretched out as far as it could go. How far do you think that would be? It would reach for many blocks along a city street! One tiny bit, a sand grain in size, would stretch five hundred feet.

Of course, your ring is not pure gold. No, your jeweler did not deceive you. He probably told you that it was twenty-two carats—or more probably eighteen carats, possibly only fourteen. That means that part of your ring is made of some other metal than gold, perhaps of silver or copper. This is very necessary, for pure gold is much too soft for common wear. It is as soft as lead. Soon you would have no ring left. So it must be hardened with some other metal.

Perhaps your ring has a tiny number and a "k" stamped inside of it. The number tells you how much gold there is. Twenty-two carats means that twenty-two parts of it are gold, and two parts are not, because twenty-four carats is the standard of gold measurement for rings. What the jeweler mixed with the gold, you can see by its color. Has it a red tinge? Then he used copper. Is it "green gold"? That means that one part is silver and three parts are gold.

All kinds of curious things can be done with pure gold. We have learned how a tiny bit of it will stretch along a city block. That same little gold particle could have been pounded until it was over a thousand times thinner than the paper of this page. When it is beaten out into such thin sheets, it is called gold-leaf.

Because a small bit of gold will spread out into such thin sheets, it would probably cost only about one hundred dollars to paper your school room with pure gold. The domes of some of our fine public buildings are covered with this sheet gold. And in foreign lands there are beautiful temples which blaze with shining gold from top to bottom.

Everyone knows that the color of pure gold is bright yellow. Yet if you look through a sheet of gold-leaf, you will find that it is a beautiful shade of green. But that is because of the action of the light through it. The upper side will still be golden. The gold names on your books were stamped from these gold-leaf sheets.

These little sheets of gold are wonderfully thin. They are so thin that it takes two hundred and fifty thousand of them to make a pile an inch high. The faintest breath blows them away. It takes great heavy hammers to pound the gold down to such thinness. In the beginning rollers are used to help flatten the gold. But afterwards, it must be pounded by hand with hammers.

Although a breath will blow away these sheets of gold-leaf, yet gold is really very heavy. It is nearly twenty times as heavy as water. Easily you could lift a quart cup of water. But that same cup filled with gold would be a heavy load for you. It would weigh nearly forty pounds. As for its value, it would be worth almost \$10,000. About \$20 an ounce is what the world has agreed upon as the price for an ounce of gold.

If a single quart of gold weighs so many pounds, what a load the wealthiest man in our country would have to lift, if all his millions were in one solid piece of gold! Only ten millions would make a bar at least three feet square. But heavy as it is, gold has many qualities which make it the best of all metals to use as money.

One good reason is that gold does not rust or easily dissolve, and rarely does it change into something else as so many other minerals do. Gold remains gold. To be sure, a little silver or copper or iron must be mixed with it, to make a combination hard enough for coins or jewelry. But that does not change the gold itself.

Nature has spent ages upon ages in making gold ready for man's use. In the beginning long ago, it was scattered through great beds of mud and clay. As the ages passed, these clay beds slowly hardened into stone. Finally tremendous upheavals came, thrusting up the stone and cracking and tilting and piling them into great mountains.

All through these rocks was the gold. But it was not yet ready for man. It was in such fine particles and so scattered, it was not possible to see it. So nature had to help once more. The waters which are always flowing through the cracks in the rocks, picked up these tiny bits of gold and carried them along.

Finally in hollows or cracks in the rocks they gathered, not able to get out or roll any farther. Usually the crack was filled with liquid quartz, which gradually hardened, holding fast its little golden prisoners. And now ages after, men find them still there, captive in the veins of quartz. "Quartz gold," they call it.

But not all the captive gold stayed fast within the rocks. Rains and frost and earthquake and heat wore away many of the rocks. Once more the little gold prisoners were free. Again the water, this time rushing down the mountain sides, whirled along the freed gold and dropped it in the hollows of the stream beds.

There men have spied it, shining as only gold can shine. In a gold-pan these placer miners, as they are called, wash away the sand and gravel in which the gold is scattered. Usually it is in small particles, but now and then big nuggets are found. Imagine the excitement when some miner suddenly discovers a nugget weighing many pounds—fifty pounds, perhaps, or one hundred and fifty! Larger ones than that have sometimes been found. Thousands of dollars these nuggets bring to the miner who finds them.

Even in the old cave days men treasured these shining nuggets of the rocks

and stream beds. As we discover and open up those prehistoric caves, there we find them, the little chunks of gold, carefully placed among their choicest possessions. And later, in ancient tombs thousands of years old, golden ornaments gleam as though the jewelers had polished them but a day or so ago.

In nearly every country of the world, gold is found. But not often in large quantities. Even in the sands along our western coast, there are flecks of gold. Real gold it is, but so scattered that it does not pay to gather it. Many times the experiment has been tried, but it has always failed. There is one most amazing place however, where gold is found. That is in the ocean water. It is really there, but as yet man has found no way to gather it. About five cents' worth floats in every ton of water. At that rate, each passing ship sails along a golden path of untold millions.

HOW COLD IS IT?

Curious, isn't it, that man depends upon one little round drop of silvery liquid to tell him how cold he is? That little drop is over there in the thermometer. When it is free it is a lively little drop. At the least slant it rolls flashing here and there. If it falls, splash it goes into dozens of tiny drops, round and shining as the big one was. It is because it is so lively and so silvery that we call it "quick silver."

Mercury is its real name, and it is about as sensitive to heat and cold as we are. Farther and farther it expands when the weather grows warm. Knowing how it will act, men place a drop of it in the hollow glass ball at the end of a thermometer. Then as the heat grows, up the little hollow tube rises the mercury. It must expand somewhere, and that is the only place left. So up it goes, as the day grows warmer, passing one by one the degrees marked on the glass.

As the heat grows less, down the tube shrinks the sensitive quick-silver again. Once more it passes the degrees on the glass, telling us just how cold we are. Perhaps the thermometer is where the cold is far below freezing. Nearly to forty degrees below zero the quick-silver will sink. Then it gives up and freezes into pretty eight-sided cubes. Without much effort these silvery cubes can be pounded into thin sheets. But if they

are carried into a warm room, soon they are once more lively little silvery drops.

Why do you suppose quick-silver has been chosen out of all the metals in the world to tell us how hot or cold we are? Because quick-silver has one strange habit which none of the other metals have. It is liquid. Not until it is as cold as about forty degrees below zero will mercury become solid. We never see tin or iron or gold or any other metal rolling around in drops like water, at ordinary temperature. For that reason, quick-silver is the only metal that can be used in a thermometer to rise and fall and so to tell us how hot or cold we are.

You would not think of your ring and the thermometer as having any connection, would you? Yet perhaps you owe your ring to that same kind of silvery liquid. The reason is this. Mercury and gold have a great attraction for each other. Closely they cling to one another whenever they meet, as you would see if you spilled some of that little thermometer drop on your ring.

Miners know how mercury and gold cling to each other. So when the gold particles in the sand or rocks are too fine to be picked up, they pour mercury over it. The sand and gravel wash away, leaving the heavy gold and mercury in a mass. When the mass is heated, the mercury grows thinner and thinner by expansion, just as it does in the thermometer. At last it disappears in vapor, and the gold dust is left. Perhaps your ring was made out of gold dust which once was picked up by this useful silvery metal.

But that little thermometer drop is connected with other things besides your ring. It has much to do with the very rosy color on ladies' faces nowadays, and with the little mirrors that they use, and with the shining red paint on your pencil. This busy silvery metal has much to do with the making of many articles which we find very necessary to have.

About the mirrors. Quick-silver combines with tin, too, as well as with gold. So, to make a mirror, a thin sheet of tin is covered with the quick-silver. Then a sheet of glass is laid upon it and pressed hard. In a little while the mixture of tin and mercury hardens on the glass. What we really see is this silvery bright coating on the back of the mirror, for of course we look straight through the glass. Because the coating is so smooth and bright, it reflects the image

of whatever comes before it.

As for the color on a lady's face, this is how it comes to be there. Out in the rocks mercury combines with sulphur and forms a bright red rock called cinnabar. When cinnabar is ground to fine powder, it is called vermillion. Then it is used to color the rouge which ladies use. It is used to give the rich red shade on your pencil too.

So you will see as you study about minerals, that one is connected with another and another, making at last a great mineral family. In some way each one is a part of our daily life, and each one has some curious habit or strange history.

For your cabinet you will want a little bottle of this curious lively quick-silver. But be sure when you handle it that you have no rings on your fingers. It will not hurt your hands and it will not even cling to your fingers. Instead, it will slip flashing between them, unless you hold them fast together. Very cold it will feel in your hand, this slippery metal. It will feel very heavy too, for it is nearly fourteen times as heavy as water.

You will want a piece of scarlet cinnabar for your cabinet too. It makes a beautiful specimen when it is pure. When clay or other matter is mixed with it, its color shades to dark red or brown. It is from cinnabar that quick-silver comes. Since cinnabar is made of mercury and sulphur, it is only necessary to separate them again to get out the quicksilver. Rarely is it found in liquid form in the rocks. That is because there are so many minerals everywhere which readily join in a close mixture with these slippery shining drops.

SHOOTING STARS

Did you see the beautiful sunset colors last evening? And did you see that bright "shooting star" which flashed across the sky a little later? And will you look at this little stone? Just an uninteresting black stone, it seems to be. And yet, this little stone and the glowing sunset and the shooting star all have very much to do with one another.

To begin with, this insignificant little stone has come to us from a million miles or more from up in the sky. A most terrific journey it was too. For centuries, so we are told, it was on its way.

From which heavenly body it first started, we cannot be quite sure. Perhaps it was shot out from the sun in some great explosion. Or perhaps some other body in the sky flung it off into space.

From wherever it first started, we know that it was not then a single little stone as it now is. Once it was a part of a great shining mass of matter dashing at tremendous speed through the heavens. We call these masses, comets. They are not stars, these comets, for the stars have their own paths in the sky and keep to them.

Comets are wandering masses of star matter. Some of them travel for a time in certain great circles. Others go wandering through space as they will, following no set path. Vagabonds of the sky, they are. Those comets which circle around the sun for awhile, we meet every so often, as trains meet and pass. This is because our earth is traveling around the sun too.

It was to one of these shining comets that this little stone once belonged. We have many proofs of it. One proof is this. For a long time astronomers and other people have watched these bright comets on their journeys through the sky. They have seen them for many years circling around the sun.

And they have seen now and then a sudden change come to one and another of these shining bodies. A terrific change it was! Some stupendous force in the sky split the great shining mass in two. For a while the two parts traveled along side by side. Then they were seen no more.

But when, like a passing train, it was time for us to meet the comet as usual, something happened to us. Quantities of bright "shooting stars" flashed across our sky. Some of these bright stars struck the earth. Men rushed to the spot. There they found hot stones buried in the earth. They dug up those stones and studied them.

The inside of the larger stones were icy cold. They were much colder than the air at the time. We know that outer space is terribly cold. It is over two hundred degrees below zero. So that was one proof that these stones had come from far up in the heavens.

But the outside of the stones were hot. That heat came from their swift fall through our atmosphere. Smaller stones were nearly melted away. But so fast had the stones rushed in their fall to the

earth, that the larger ones did not have time to wholly melt. Such flashing speed! Thirty miles a second they were going when they reached our air.

Our atmosphere being thick, slowed them down somewhat. But the friction heated them white hot. Many of them exploded, and their passing sounded like thunder. Down into the earth they tore their way, some of them for several feet. Those which struck on hard stone burst into bits. But those falling onto soft earth were not so broken. So we find meteor stones of all sizes, from great pieces weighing five hundred pounds or more, down to little stones like this one.

Ever since the memory of man, these shooting stars have been flashing across the sky. Almost constantly our earth is passing near or through a swarm of these dark stones, left floating in the sky from some old exploded comet. As they feel the earth's atmosphere pulling them, they come rushing down to us, bursting into heat and light as they reach our atmosphere.

All over the world they have fallen, these meteoric stones. But the largest one which ever crashed to the earth fell in Arizona. So large and deep a hole it made, it must have weighed many tons, and much of it was iron. It bored a hole four thousand feet across and nearly twelve hundred feet deep.

Where it struck were layers of solid rock which splintered it to fragments. This little stone is one of them. Thousands of these fragments lie around the rim of the great hole. Cañon Diablo meteorites, they are called. Some people estimate that it must have been about five thousand years ago that this great comet hit the earth.

SKY STONES

Now about these strange stones themselves, these "fragments of other worlds" which have come hurtling down to us from the sky. What are they like, these meteorites? Some of them are stony, and others are almost wholly made of metals. Iron and copper and nickel are sure to be in them. Graphite, which is the "lead" in your lead pencils, has been found in certain ones. Radium, platinum, quartz and glass are in others. Altogether, over twenty kinds of minerals have been discovered in these meteoric stones, some in the shape of little crystals.

But most amazing of all, tiny diamonds have been found in some of the meteorites at Cañon Diablo. Imagine being showered by diamonds from the sky. Could anything be more like a fairy tale? Yet they are true diamonds. But after all it is scarcely more wonderful than that these pieces of exploded worlds come to us at all, showing us that those bright stars up there are made of the same materials as our own earth.

If you cannot go to the Cañon Diablo to pick up specimens of these meteoric stones for your cabinet, they can be purchased from some dealer in minerals. You can scarcely imagine the thrill of holding in your hand one of these pieces of another world. To know that it came from millions of miles up in the sky, and that it may have been floating there for centuries.

Thrilling, indeed, it is to think that perhaps it was the terrific collision of two great heavenly bodies that exploded the little stone off on its wanderings as part of a meteor. To realize that in its journeys it may have passed close to some of the bright stars we see each night in the sky—stars which are more than a thousand times larger than our earth.

After this, we will watch eagerly, will we not, for these visitors from other worlds? We will watch to see them fall, hoping they will come near enough for us to pick them up, as hundreds of others have been picked up all over the earth. The other specimens for our cabinet we can find by searching or mining for them. But no one can get one of these strange "sky stones," as the Indians call them, until it comes flashing down to us from the heavens.

STAR DUST

What has the sunset to do with these strange shooting stars and curious sky stones? It has this to do with them. If they were not there in space above us, our beautiful sunset colors would not be nearly so bright and gorgeous as they are now.

The reason for it is this. It is the sunlight shining on the particles of moisture or dust in the air, which makes our beautiful sunset colors. While much

of that dust has been whirled up from the earth itself, a part of it is star dust. It is dust which is drifting down to earth from those exploded worlds up there in the sky.

We have seen how the sky stones of all sizes are always falling somewhere on the earth. They are like the larger particles in a rain of star dust. The fine dust particles settle more slowly. They are not heavy enough to rush down through the air, and so be set on fire.

In the meteoric stones are certain minerals and peculiar formations which label them as sky stones. The meteoric dust is made of these same minerals and has the same shape. So when we find this dust on arctic snowfields and other places where there is practically no earth dust, we know that it has drifted down to us from the heavens.

All over the earth this curious star dust is found, even in the ocean. If you watch the sky on a clear night you will probably see at least six or eight shooting stars in an hour. In the early morning there are more to be seen than at night. Altogether, as many as twenty millions come to the earth in each twenty-four hours. This is what we are told by those who make a study of the heavens.

Not all of the shooting stars reach the earth as stones, however. Many are burned up in the air, doubtless leaving an ash-dust to fall slowly. With all this mass of matter coming to our sky, can you not imagine the quantity of dust which must come from it? Over thirty-five thousand tons of star matter fall upon us in a year, we are told. How this must add to our earth dust and help in making sunset colors.

Sunset dust has been falling since the millions upon millions of years ago when our world began. In that long time what quantities of it have been added to the earth, and gradually hardened into stone. As we know, it is from the rocks that we get our interesting specimens of ores and crystals. And this is how, as the ages have passed, the star dust in the sunsets has helped to make the beautiful specimens in our cabinets.

PUBLICATIONS RECENTLY RECEIVED

Bibliography of North American Geology for 1923-24: By John M. Nickles—200 pages. This bibliography, containing paleontology, petrology and mineralogy, for the years 1923 and 1924, contains publications on the geology of the Continent of North America and the adjacent islands and on Panama and the Hawaiian Islands. It includes textbooks and papers of general character by American authors, but not those by foreign authors, except papers that appear in American publications. Issued by the U. S. Geological Survey, Washington, D. C., as Bulletin No. 784.

Geology and Ore Deposits of the Mogollon Mining District, New Mexico: By Henry G. Ferguson—100 pages, 25 plates, 5 figures—has recently been issued by the U. S. Geological Survey, Washington, D. C., as Bulletin No. 787.

Shorter Contributions to General Geology—1926: By W. C. Mendenhall, Chief Geologist—48 pages, 17 plates, 1 figure—recently made its appearance as Prof. Paper No. 147. Issued by the U. S. Geological Survey, Washington, D. C.

Correlation of Geologic Formations between East-Central Colorado, Central Wyoming and Southern Montana: By Willis T. Lee—80 pages, 35 plates, 5 figures—is another interesting publication of the U. S. Geological Survey and is known as Prof. Paper No. 149.

Geology and Ore Deposits of the Leadville Mining District, Colorado: By S. F. Emmons, J. D. Irving, and G. F. Loughlin—368 pages, 70 plates, 111 figures. This is an interesting report on a famous mining district of Colorado. The illustrations and figures are excellent, but of chief interest to collectors are the minerals described and in many cases illustrated. Issued also by the U. S. Geological Survey as Prof. Paper No. 148.

Report on Mining Operations in the Province of Quebec during the year 1926:

A valuable review (188 pages) of the mining industry with many statistical tables and excellent illustrations. Issued by the Department of Colonization, Mines, and Fisheries, Quebec, Que., Can.

Analyses Lake Superior Iron Ores—Season 1926: This little booklet (37 pages) giving valuable data on the analyses of Lake Superior iron ores, should be of special benefit to those interested in iron ores in general and Lake Superior ores in particular. Issued by the Lake Superior Iron Ore Association, Union Trust Bldg., Cleveland, Ohio.

Nature Notes of Grand Canyon: Vol. 2, Numbers 2 and 3, issued by the U. S. Department of the Interior, National Park Service, Grand Canyon National Park, have come to the Editorial desk. These bulletins are issued monthly for the purpose of giving information to those interested in the natural history and scientific features of the Grand Canyon National Park. Copies of these bulletins may be obtained free of charge by those who can make use of them by addressing the Superintendent, Mr. M. R. Tillotson, Grand Canyon National Park, Grand Canyon, Ariz.

The copies we have received are most interesting bulletins on some of the birds, flowers, animals, butterflies, geological formations of the Canyon with illustrations, etc. They also contain some very interesting Canyon notes.

We are not sure whether any of the other national parks issued such bulletins and we wish to congratulate Mr. Tillotson, the Superintendent, and Mr. G. E. Sturdevant, the Park Naturalist, for their enterprise in this direction. The bulletins should certainly be read by everyone intending to visit the Canyon. For those of us who may not have such an opportunity the bulletins contain a great deal of interesting information that it is a pleasure to have in one's library.

MINERAL COLLECTING FOR YOUNG PEOPLE

ELIZABETH V. BROWNE,

I am writing this article in hope that the boys and girls who read it may more fully understand that Mineral Collecting is not a hobby confined solely to adults, but that it is equally enjoyable for children. I can imagine no greater pleasure than that which I derive from my specimens and it is my wish that other children experience the same happiness.

It is now over three years ago that I first became interested. The discovery of a tiny Quartz crystal in a stream-bed aroused a longing to learn more about my find and to possess a collection such as the one I had so often admired in the house of a friend. Three years of happiness later proved to have hinged upon the finding of that minute distorted crystal.

Not long after the occurrence stated above, I saw Mr. Zodac's advertisement in a magazine; so I sent him a trial order. I was so pleased with it that I began saving all my money for minerals—and I have ever since. I leave the choice of my specimens largely to Mr. Zodac and I can scarcely wait to receive them. I always get a thrill when the package arrives, opening it with breathless interest and unwrapping each specimen excitedly. I think that the best way is to leave the selection to Mr. Zodac because each specimen is a beautiful surprise. I really must say that he has been a wonderful help to me and I owe him many thanks.

My hobby is very instructive as well as pleasurable. How much more sensible it would be for boys and girls to save the money they would otherwise spend on candy or ice cream, which is soon gone with nothing to show for it, and use it for mineral specimens instead. Now I spend all my money on additions to my collection—and there is nothing that I would rather have. My income consists of a small sum per week, so you can readily see that one does not have to be wealthy to collect. Good specimens can be obtained at your dealers for from five cents up. My collection consists of minerals from ten cents up to thirty-five cents per specimen, though I have some of the higher priced varieties. It is a good plan for the beginner to purchase at

first a small collection which will cost but a dollar or so; it depends upon the size and quality of the specimens. These are very interesting and such a collection is indeed a bargain.

As my collection grew, I found that it was necessary to have some special place in which to display my treasures, so my mother gave me a bookcase with a glass door and four shelves as a Christmas present. Of course at the time I didn't have enough minerals to occupy all the shelves so I kept curios on them, later removing the various articles as my collection increased. Now it is filled—and I need a new shelf, my collection numbering at present a few over four hundred specimens.

The arrangement that I prefer is by localities: the minerals from, let us say, California, are arranged together and so on with the various states and countries. I do not abide strictly by this plan, as I have devoted one entire shelf to the rough and polished semi-precious stones. Probably there are better and more scientific methods, but so far I prefer my own.

I happen to have a typewriter, so I print an individual card for each mineral, numbering and cataloging them in a similar manner. I like my collection better than anything else I possess and each specimen seems like a friend.

ROCKS AND MINERALS has helped me a great deal, not only in teaching me more about my favorite subject, but also by introducing me to new dealers. I happen to have purchased a few nice specimens from the Gem Shop of Wolf Creek, Mont., and from Mr. Shelley Denton, of Wellesley, Mass., but the greater part of my collection is from Mr. Zodac. He certainly has wonderful values and is very helpful to the beginner.

The happiest moments of my life were spent at Mount Apatite, Maine, which I visited for not over half an hour. The joy of gathering and identifying specimens cannot be surpassed by any other pleasure in the world according to my estimation. I felt just as though I had discovered Captain Kidd's buried trea-

sure, so fascinated was I by the wonderful minerals surrounding me.

My one great ambition is to make mineralogy my life work. I really am at a loss to know what I'd do without my precious collection. My friends at school think I am extremely foolish to spend all my money on minerals instead of a new tennis racket or candy, but I doubt that they get one-tenth of the enjoyment from their purchases that I do out of my Mineralogy.

"Long Live Mineral Collecting" is my war cry, and I look forward expectantly to the day when my friends have collections of their own and no longer call me

"crazy" for spending my money on "stones."

So boys and girls, double your present happiness as I have done by starting a collection right away. If any of you wish to write me in regard to my collection, I shall be only too glad to answer you, giving all the information possible as well as encouragement. I feel sure that after you get started you will agree with me in saying that our hobby "can't be beat."

Miss Browne's address, for those who may wish to write her, is 33 Emerson Avenue, Pittsfield, Mass.

EDITOR.

THE SLUICE BOX

By A. RIFFLE

The mining industry was well represented at the Montana State Fair this year. Working models of stamp mills and other mining machinery and appliances were displayed. Chart models made of glass with the various tunnels, shafts, levels, and underground workings of a Butte property graphically shown in three dimensions was an interesting feature. Statistical charts with staggering figures showed the value of mining as an industry in our State. Every class of mining property, from the newly discovered prospect to the older dividend-paying mines, were represented in the ore displays. Gold scales, assaying appliances, the tools of the prospector and countless other things that are part of the great mining game were also shown. In addition there was a considerable showing of cabinet mineral specimens belonging to different private collectors. The entrance to the mineral section was timbered and lagged and overlaid with rocks and sod in an unmistakeable representation of the mouth of a prospect tunnel. The display drew much favorable and enthusiastic comment from all who saw it. Mr. George B. Conway, a well-known mineralogist of Helena, had charge of this section.

Tourist: "So this is petrified wood?"
"Old Bill": "Yes, Ma'am."

Tourist: "How did the wood change to stone?"

"Old Bill": "Ages ago this country was covered with a heavy forest. A strong wind-storm came along and made all the trees rock."

The mineral-collection fraternity has one task ahead of it for the coming winter that we must not fall down on. That is to get squarely behind Mr. Zodac and put ROCKS AND MINERALS on such a firm foundation that we can be assured of enjoying the magazine for years to come. Lean back in your chair right now and devote a few minutes to thinking out some way in which you can boost subscriptions or advertising for ROCKS AND MINERALS. This magazine is filling what was a mighty big vacancy and let's see to it that it stays filled.

"Old Bill" says that Mr. Zodac has more self-restraint than any other editor in the country. He looked through the September issue twice and could not find Charles Lindbergh mentioned anywhere.

GLOSSARY DEPARTMENT

A list of various mining, mineralogical, and geological terms, with explanation of each one. Free use has been made of various publications on mining, mineralogy, and geology, including bulletins of the U. S. Bureau of Mines and the U. S. Geological Survey. Webster's New International Dictionary has also been consulted.

Algodonite: A steel-gray to silver-white copper arsenide, that becomes dull on exposure. It was first found at the silver mines of Algodones (whence its name), near Coquimbo, Chile. Also found in the copper mines of Lake Superior.

Algonkian: A name given to a group of rocks which are second in order of age of the systems into which rocks are divided. They are the upper half of Precambrian Rocks.

Alkahest: In alchemy, an imaginary liquid which was said to be a universal solvent, capable of separating all compounds into their constituent elements.

Alkali: In chemistry, any substance having marked basic properties. They are soluble in water, will neutralize acids and form salts with them, and will turn red litmus blue. Some common alkalies are hydroxides of potassium, sodium, lithium, and ammonium.

Alkali flat: In geology, it is a barren plain, containing an excess of alkali, that is met with in dry and hot regions and at the bottom of an undrained area.

Alkali metal: Any one of the following: Caesium, lithium, potassium, rubidium, or sodium. These metals form the alkali group (see Alkali).

Alkalimeter: An instrument for determining the strength of alkalies, or the quantity of an alkali in a mixture.

Alkaline: Minerals having the taste of soda, or any substance having the properties of an alkali.

Alkaline earths: The oxides of barium, calcium, and strontium.

Alkaline metals: Same as alkali metals.

Allanite; Orthite: A rare mineral closely related to common Epidote. It is brown to black in color and contains a number of rare elements. Named after T. Allan, who first discovered the mineral. Orthite is the variety found in slender, needle-like (acicular) crystals, often a foot in length.

Allemonite: A tin-white or reddish-gray metallic mineral containing antimony and arsenic.

Allocroite: A brown to reddish-brown variety of Garnet (Andradite).

Allomorph: In mineralogy, a pseudomorph formed without change of chemical composition, as Calcite after Aragonite.

Allotrope: One of the forms assumed by an allotropic substance; as the diamond is an allotrope of carbon.

Allotropy; Allotropism: The ability of existing in two or more conditions, that are distinguished by differences in properties. Thus carbon occurs crystalline as in the diamond, and amorphous as in charcoal.

Alloy: A compound of two or more metals, usually produced by fusion.

Alluvial: A term used in geology to describe a deposit made by flowing water.

Alluvial epoch: In geology, it is the latter part of the Champlain period (Quaternary), overlying the Diluvial period.

Alluvial fan: The outspread sloping deposit of boulders, gravel, and sand left by a stream where it spreads from a gorge upon a plain or open valley bottom.

Alluvial gold: Gold found in alluvial deposits.

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